INEEL/EXT-02-01508
Revision 0

Project No. 22901

Health and Safety Plan for the TSF-09/18 (V-Tanks) and TSF-21 Early Remedial Action Field Sampling, Equipment Removal and Disposal at Test Area North, Waste Area Group 1, Operable Unit 1-10

Todd F. Lewis CIH

May 2003

Idaho National Engineering and Environmental Laboratory
Bechtel BWXT Idaho, LLC

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Environmental Restoration Program
Idaho Falls, Idaho 83415

Prepared for the
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Assistant Secretary for Environmental Management
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Health and Safety Plan for the TSF-09/18 (V-Tanks) and TSF-21 Early Remedial Action Field Sampling, Equipment Removal and Disposal at Waste Area Group 1, Operable Unit 1-10

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ABSTRACT

This health and safety plan establishes the procedures and requirements that will be used to eliminate or minimize health and safety risks to personnel working at the Technical Support Facility (TSF)-09/18 (V-Tanks) and TSF-21 early remedial action field sampling, equipment removal and disposal at Test Area North, Waste Area Group 1, Operable Unit 1-10, as required by the Occupational Safety and Health Administration standard "Hazardous Waste Operations and Emergency Response (29 CFR 1910.120)." This health and safety plan contains information about the hazards involved in performing the work as well as the specific actions and equipment that will be used to protect personnel while working at the task site.

This health and safety plan is intended to give safety and health professionals the flexibility to establish and modify site safety and health procedures throughout the entire span of site operations based on the existing and anticipated hazards.

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ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
CERCLA	Comprehensive Environmental, Response, Compensation and Liability Act
CRC	contamination reduction corridor
CRZ	contamination reduction zone
dBA	decibel A-weighted
DOE	U.S. Department of Energy
DOE-ID	U.S. Department of Energy Idaho Operations Office
EPA	U.S. Environmental Protection Agency
ERO	Emergency Response Organization
ES&H	environment, safety, and health
FFA/CO	Federal Facility Agreement and Consent Order
FTL	field team leader
HASP	health and safety plan
HAZWOPER	hazardous waste operations and emergency response
HEPA	high-efficiency particulate air
HSO	health and safety officer
ICP	Idaho Completion Project
IH	industrial hygienist
INEEL	Idaho National Engineering and Environmental Laboratory
JSA	job safety analysis
MCP	management control procedure
OMP	Occupational Medical Program
OSHA	Occupational Safety and Health Administration

OU	operable unit
PCB	polychlorinated biphenyl
PEL	permissible exposure limit
PLN	plan
PPE	personal protective equipment
PRD	program requirements document
RadCon	Radiological Control
RCT	radiological control technician
RD/RA	remedial design/remedial action
RCRA	Resource Conservation and Recovery Act
REM	roentgen equivalent man
RWP	radiological work permit
SWP	safe work permit
TAN	Test Area North
TCLP	toxicity characteristic leaching procedure
TLV	threshold limit value
TPR	technical procedure
TSF	Technical Support Facility
TWA	time-weighted average
UV	ultraviolet light
VOC	volatile organic compound
VPP	Voluntary Protection Program
WAG	waste area group
WCC	Warning Communications Center

Health and Safety Plan for the TSF-09/18 (V-Tanks) and TSF-21 Early Remedial Action Field Sampling, Equipment Removal and Disposal at Test Area North, Waste Area Group 1, Operable Unit 1-10

1. INTRODUCTION

1.1 Purpose

This health and safety plan (HASP) establishes the procedures and requirements that will be used to prevent health and safety hazards from affecting personnel working at the Technical Support Facility (TSF)-09/18 (V-Tanks) and TSF-21 early remedial action field sampling, equipment removal and disposal at Test Area North (TAN), Waste Area Group (WAG) 1, Operable Unit (OU) 1-10, at the Idaho National Engineering and Environmental Laboratory (INEEL). The location of the INEEL within the State of Idaho is shown in Figure 1-1.

1.2 Scope and Objectives

This HASP has been written to meet the requirements of the Occupational Safety and Health Administration (OSHA) standard, "Hazardous Waste Operations and Emergency Response (HAZWOPER)" (29 CFR 1910.120). This HASP governs all work at the TSF-09/18 (V-Tanks) and TSF-21 early remedial action field sampling, equipment removal and disposal at WAG 1, OU 1-10 that is performed by INEEL management and operations contractor personnel, subcontractors, and any other personnel who enter the project area.

This HASP has been reviewed and revised as deemed appropriate by the health and safety officer (HSO) in conjunction with other project personnel and management to ensure its effectiveness and suitability.

1.3 Idaho National Engineering and Environmental Laboratory Site Description

The INEEL, formerly the National Reactor Testing Station, encompasses 2,305 km^2 (890 mi^2), and is located approximately 51.5 km (32 mi) west of Idaho Falls, Idaho. The U.S. Department of Energy Idaho Operations Office (DOE-ID) has responsibility for the INEEL and designates authority to operate the INEEL to government management and operating contractors.

The United States Atomic Energy Commission, now the U.S. Department of Energy (DOE), established the National Reactor Testing Station (now the INEEL) in 1949 as a site for building and testing a variety of nuclear facilities. The INEEL also has been the storage facility for transuranic radionuclides and radioactive low-level waste since 1952. At present, the INEEL supports the engineering and operations efforts of DOE and other federal agencies in areas of nuclear safety research, reactor development, reactor operations and training, nuclear defense materials production, waste management technology development, energy technology and conservation programs, and DOE long-term stewardship programs.

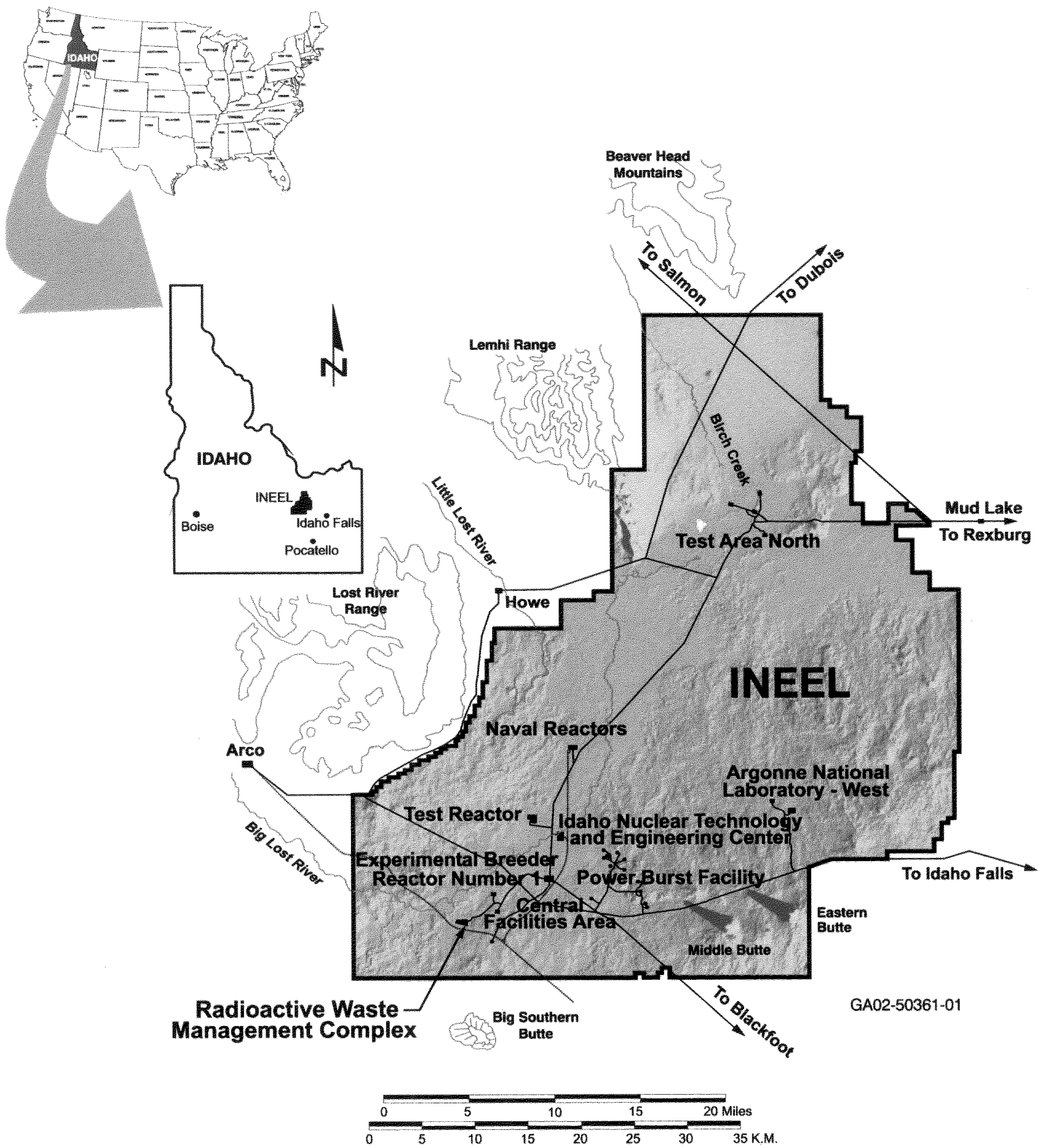

Figure 1-1. Location of the Idaho National Engineering and Environmental Laboratory.

1.4 Background and Project Site Description

The INEEL is a U.S. government-owned test site, managed by the Department of Energy (DOE), and located in southeastern Idaho, 51.5 km (32 mi) west of Idaho Falls, as shown in Figure 1-1. The laboratory encompasses approximately 2,305 km^2 (890 mi^2) of the northeastern portion of the Eastern Snake River Plain. The Eastern Snake River Plain is a relatively flat, semiarid sagebrush desert with predominant relief manifested either as volcanic buttes jutting up from the desert floor or as unevenly surfaced basalt flows or flow vents and fissures (DOE-ID 1999). Elevations on the INEEL site range from 2,003 m (6,572 ft) in the southeast to 1,448 m (4,750 ft) in the playas (Figure 1-2) with an average elevation of 1,516 m (4,975 ft). Drainage within and around the plain recharges the Snake River Plain Aquifer, which flows beneath the INEEL and the surrounding area (DOE-ID 1997). The top of the aquifer slopes from about 61 m (200 ft) below the surface at Test Area North (TAN) to about 183 m (600 ft) below the surface at the Radioactive Waste Management Complex (RWMC). The aquifer is overlain by lava flows and sediment (DOE-ID 1999).

The U.S. Atomic Energy Commission initially established the facility in 1949 as the National Reactor Testing Station for nuclear energy research and related activities. In 1952, the facility was expanded to accept shipments of transuranic radionuclides and low-level waste. It was named the Idaho National Engineering Laboratory in 1974. In 1997, the Site was renamed the INEEL to reflect its expanded mission to include a broader range of engineering and environmental management activities. Currently, the INEEL is primarily used for nuclear research and development and waste management (DOE-ID 1999).

In November 1989, the Environmental Protection Agency (EPA) placed the INEEL on the *National Priorities List of the National Oil and Hazardous Substances Pollution Contingency Plan* (54 Federal Register [FR] 48184) because of confirmed contaminant releases to the environment. In response to this listing, the Agencies, composed of the DOE, EPA, and the Idaho Department of Environmental Quality, negotiated a Federal Facility Agreement and Consent Order (FFA/CO) and an action plan. The FFA/CO and action plan were signed in 1991 by the Agencies, thereby establishing the procedural framework and schedule for developing, prioritizing, implementing, and monitoring response actions at the INEEL in accordance with Comprehensive Environmental, Response, Compensation, and Liability Act (CERCLA), Resource Conservation and Recovery Act (RCRA), and the Idaho Hazardous Waste Management Act (DOE-ID 1991).

To better manage cleanup activities, the INEEL was divided into 10 waste area groups (WAGs). TAN is designated as WAG 1, which includes the Technical Support Facility (TSF), the Initial Engine Test (IET) Facility, the Loss-of-Fluid Test (LOFT) Facility, the Specific Manufacturing Capability Facility (SMC), the Water Reactor Research Test Facility (WRRTF) fenced areas, and the immediate areas outside the fence lines (DOE-ID 1999).

Located in the north-central portion of the INEEL (Figures 1-2 and 1-3), TAN was constructed between 1954 and 1961 to support the Aircraft Nuclear Propulsion Program, which developed and tested designs for nuclear-powered aircraft engines until the research was terminated by congress in 1961. The area's facilities were then converted to support a variety of other DOE research projects. From 1962 through 1986, the area was principally devoted to the LOFT Facility, which was used to perform reactor safety testing and studies. Beginning in 1980, the area was used to conduct research and development with material from the 1979 Three Mile Island reactor accident (DOE-ID 1998). During the mid-1980s, the TAN Hot Shop (DOE-ID 1999) supported the final tests for the LOFT program. Current activities include the manufacture of armor for military vehicles at the Specific Manufacturing Capability Facility, and nuclear inspection and storage operations at TSF. The IET Facility has been deactivated, decontaminated, and decommissioned by the INEEL Deactivation, Decontamination, and Decommissioning program.

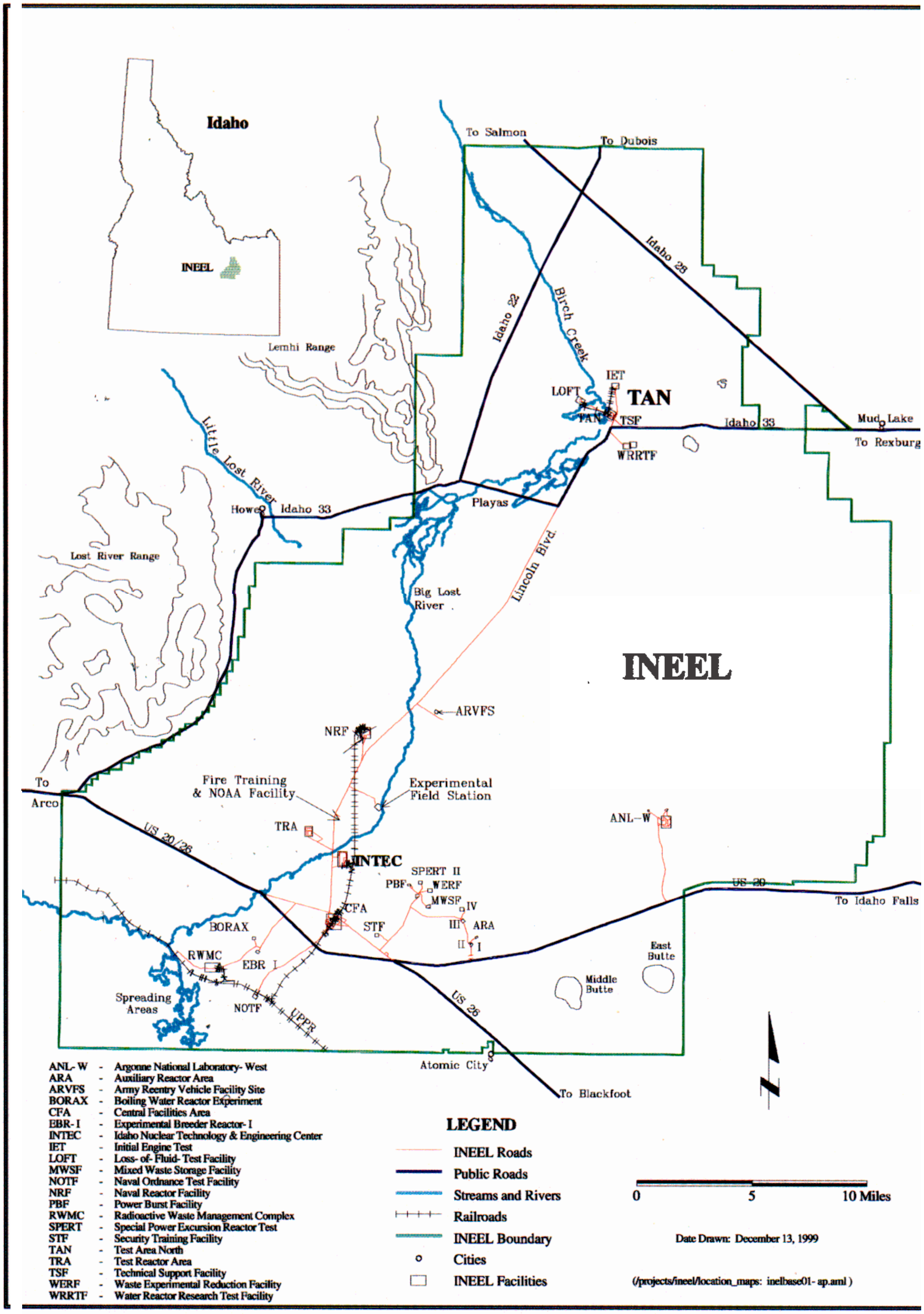

Figure 1-2. Location of Test Area North at the Idaho National Engineering and Environmental Laboratory.

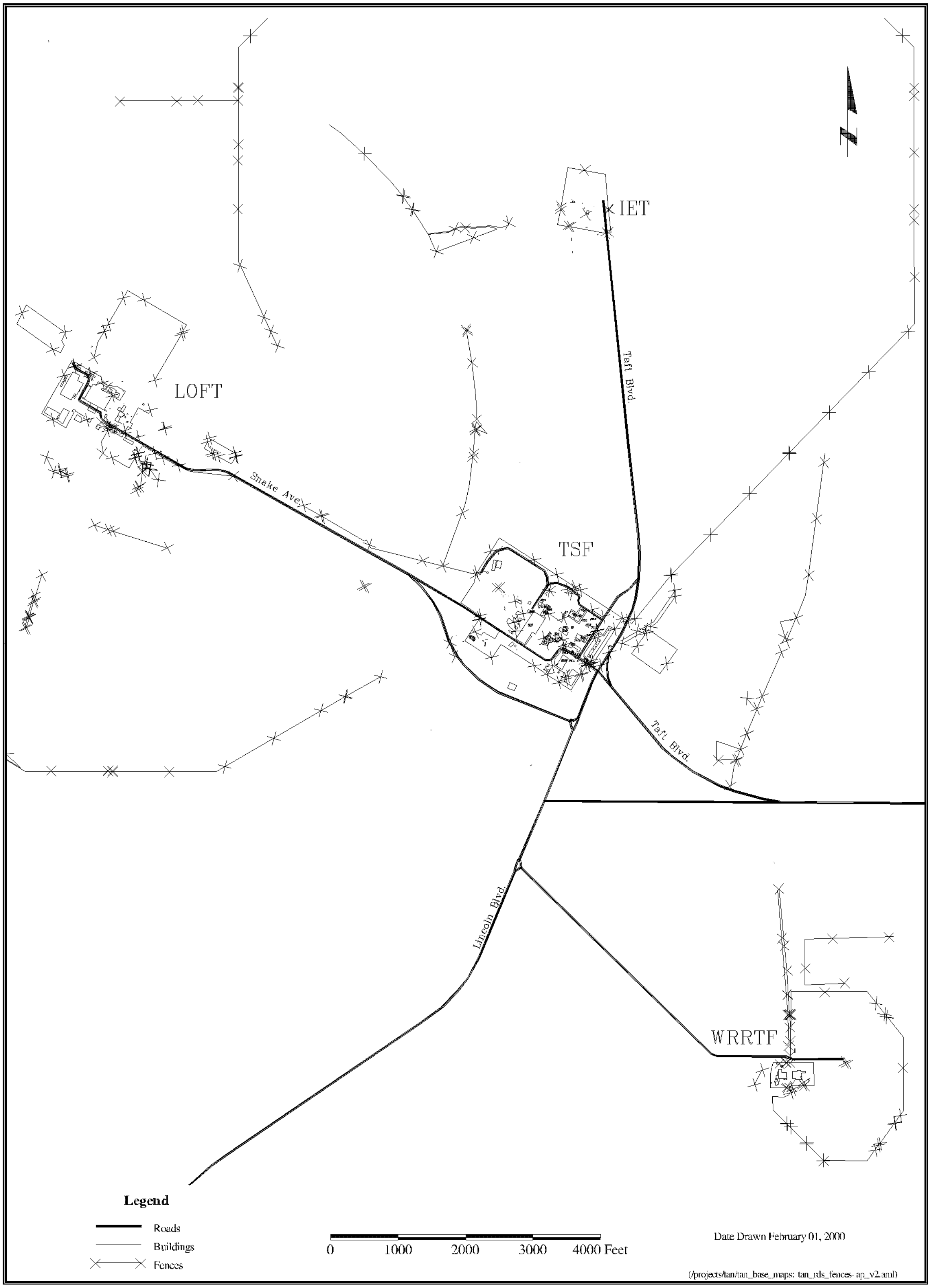

Figure 1-3. Test Area North facilities.

In 1991, the FFA/CO established 10 OUs within WAG 1, consisting of 94 potential release sites (DOE-ID 1997). The sites include various types of pits, numerous spills, ponds, aboveground and underground storage tanks (USTs), and a railroad turntable. A comprehensive remedial investigation/feasibility study (RI/FS) was initiated in 1995 to determine the nature and extent of the contamination at TAN. The FFA/CO defines OU 1-10 as the comprehensive WAG 1 RI/FS (DOE-ID 1997), which culminated with the OU 1-10 Record of Decision (ROD). Final remediation goals (FRGs) were established in the ROD based on long-term risks associated with Cs-137 activity. This health and safety plan (HASP) details the soil sampling activities to be conducted prior to excavation and removal of the OU 1-10 V-Tanks (TSF-09 and TSF-18). TSF-21 was removed in 1993; however, this HASP also details soil sampling activities in this area.

The TSF Intermediate-Level (Radioactive) Waste Disposal System (TSF-09) and the TSF Contaminated Tank (TSF-18) are situated in an open area east of TAN-616 and north of TAN-607 (Figure 1-4). TSF-09 consists of three abandoned USTs (Figure 1-5), and TSF-18 consists of one abandoned UST and a concrete sand filter (Figure 1-6). The V-Tanks (V-1, V-2, V-3, and V-9) at TSF-09 and TSF-18 were installed in the early 1950s as part of the system designed to collect the following for treatment:

- Radioactive liquid effluents generated in the hot cells, laboratories, and decontamination facilities at TAN

- Waste from the IET Facility.

Based on process knowledge and work site use, the remedial investigation/feasibility study concluded that the known or suspected types of contamination at the work sites include metals (barium, cadmium, chromium, lead, mercury, and silver), volatile organic compounds (VOCs) (trichloroethene, 1,1,1-trichloroethane, carbon tetrachloride, and acetone), semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), and radionuclides (Cs-137, Co-60, Sr-90, and various isotopes of plutonium and uranium) (DOE-ID 1997).

The history and uses of the TSF-09 Tanks (Tanks V-1, V-2, and V-3) are better documented than the history and uses of Tank V-9. Since their installation, the three 37,850-L (10,000-gal) tanks have been used to store radioactive liquid wastes generated at TAN. The waste collected in the tanks was treated in the evaporator system located in TAN-616. Treatment residues were sent to the TSF injection well or the PM-2A Tanks at TSF-26. After the evaporator system in TAN-616 failed in 1970, waste stored in the TSF-09 Tanks was sent directly to the PM-2A Tanks. After 1975, waste that had accumulated in the TSF-09 Tanks was pumped out and shipped to the Idaho Chemical Processing Plant by tanker truck. Spills during tank operation and runoff from an adjacent cask storage pad reportedly contaminated surface soils surrounding the tank.

In 1968, a large quantity of oil was discovered in Tank V-2, and the tank was taken out of service. The oil was removed from Tank V-2 in 1981, and the liquid in the three tanks (V-1, V-2, and V-3) was removed in 1982. During removal of the liquid, approximately 6,434.5 L (1,700 gal) were accidentally allowed to drain onto the ground. The liquid puddled in a soil depression along the west side of the tank manways and flowed north out of the radiologically controlled area through a shallow ditch. Cleanup operations removed approximately 3.8 m^3 (128 ft^3) of radioactive soil in a 0.9-m^2 (10-ft^2) area north of the tanks and outside the posted Radiological Control (RadCon) zone, and the excavation was backfilled with clean soil. There are no indications that clean soil was placed in the area around the tanks following the spill. The tanks have not been used since the 1980s, although liquids (i.e., rainwater and snowmelt) have accidentally accumulated in Tank V-3 since the 1980s (DOE-ID 1997).

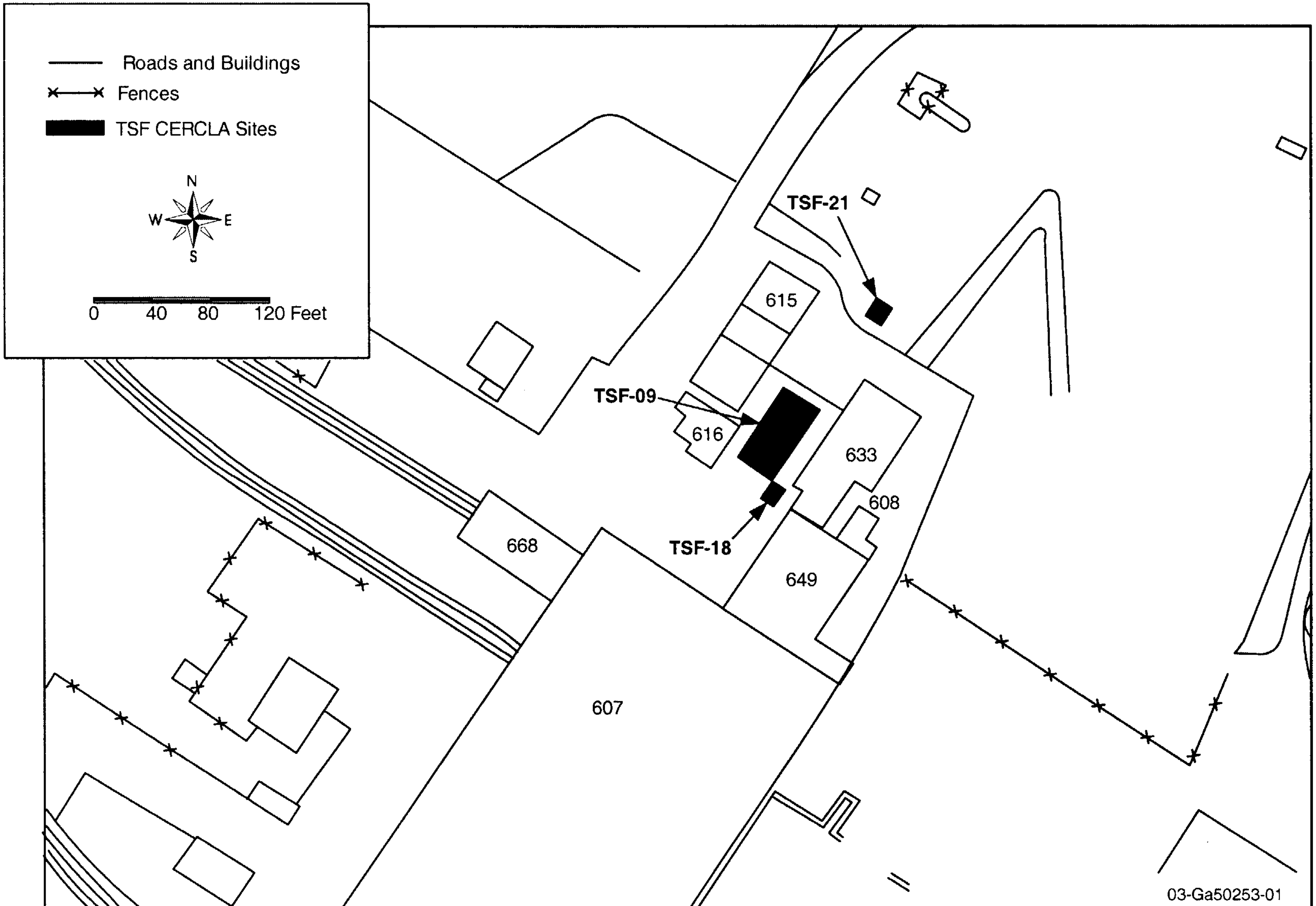

Figure 1-4. Location of TSF-09, TSF-18, and TSF-21.

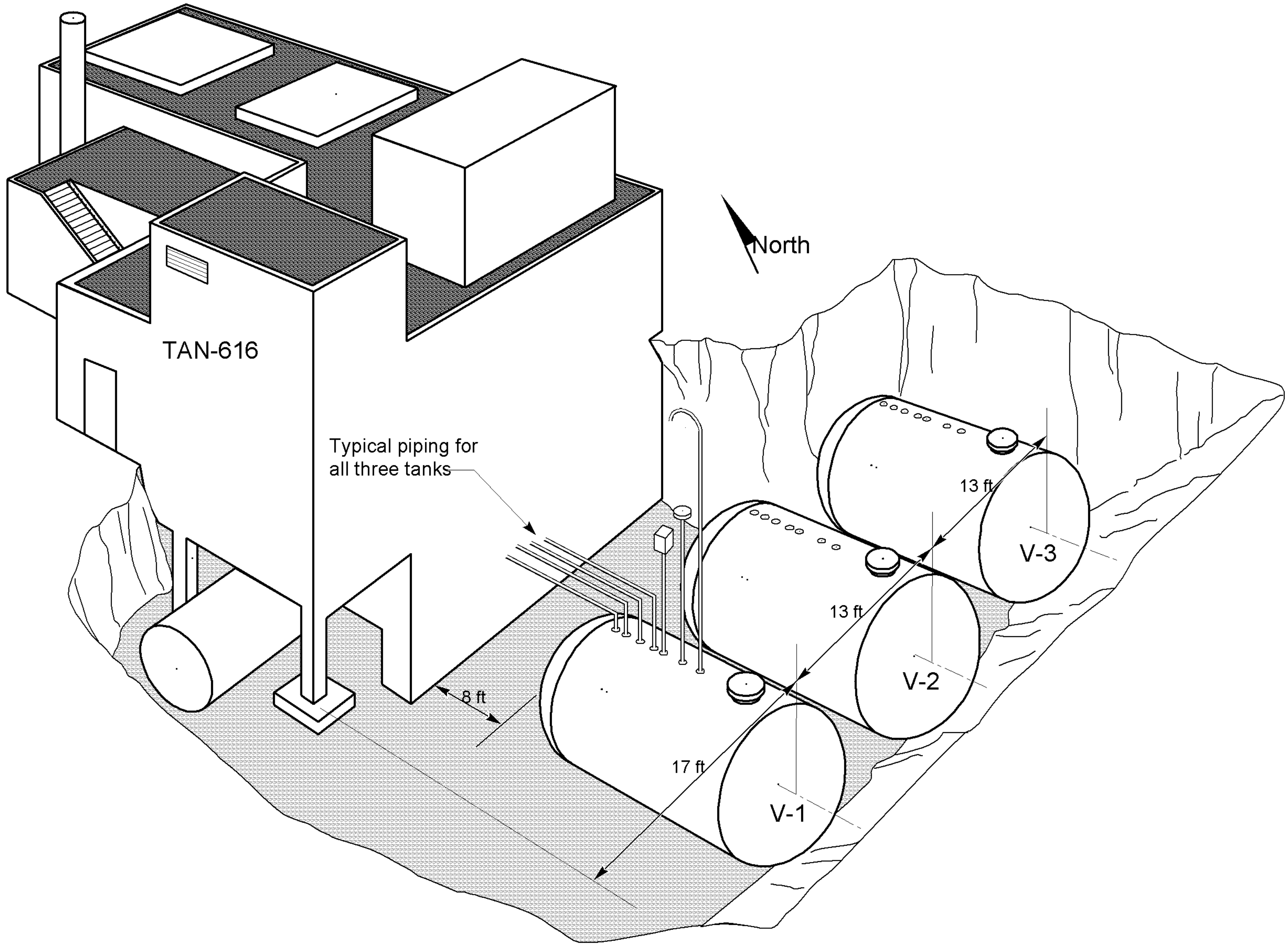

Figure 1-5. Diagram of Tanks V-1, V-2, and V-3.

The ditch ran plant east between buildings TAN-616 and TAN-615 (Figure 1-4) (see Note). At the end of building TAN-615, the ditch ran plant north to the end of the building, then plant west along the building, then plant south along the building, approximately 1/3 the length of the building, and finally plant west away from the building and into a culvert. The terrain above the V-Tanks and west of the TAN-633 (Hot Cell Area) sloped toward the ditch. At this time, it is unknown whether the above spill made its way all along the ditch and into the culvert.

Note: The TAN-615 structure was demolished in 2002. Its inclusion in the text and in Figure 1-4 serves to show the approximate location of the drainage ditch discussed in this HASP.

The tank at TSF-18, referred to as Tank V-9 (Figure 1-7), is a 1,514-L (400-gal) stainless steel sump tank located approximately 2.1 m (7 ft) to 4.2 m (14 ft) below ground surface. Tank V-9 is accessible by a 15.2-cm (6-in.) diameter riser that extends to the ground surface. The conical tank is 42 in. in diameter in the center and extends approximately 2.1 m (7 ft) down to the tip of the cone. Based on information obtained during the remedial investigation, the tank contains approximately 0.9 m (3 ft) of sludge, 0.9 m (3 ft) of liquid, and 0.3 m (1 ft) of head space. The total volume of material in Tank V-9 was estimated at 1,216 L (320 gal). Radiation readings in the tank range from 9 mrem/h on contact just inside the 15.2-cm (6-in.) riser to 10,500 mrem/h just inside the tank. The tank was installed in the early 1950s and was indicated as a sump tank in facility "as-built" drawings. The visual evidence collected during the remedial investigation is consistent with the tank configuration shown in earlier "as-built" drawings (DOE-ID 1997).

Results from sampling and analysis of Tank V-9's contents performed during the remedial investigation indicate that chemicals in the tank are very similar to those found in the tanks at TSF-09. High concentrations of Sr-90, Cs-137, Co-60, and trichloroethene detected during analysis are consistent with those found in the TSF-09 tanks during the Track 2 investigation in 1993. Internal visual evidence obtained with a remote camera during the remedial investigation indicates that the tank is in good condition (DOE-ID 1997). Eight additional samples were collected from Tank V-9 in May 2001 and analyzed for uranium isotopes and toxicity characteristic leaching procedure (TCLP) metals, including mercury. Data from this sampling activity was used to further address criticality concerns. No criticality concern was noted.

1.4.1 Preliminary Soil Investigations

A survey of the soil in the tank area was performed in 1980 and 1983, and composite soil samples were taken from six trenches within the area. The survey area included a 15 × 24-m (50 × 80-ft) surface area above the tanks. This area was staked off in 3 × 3-m (10 × 10-ft) grids originating in the southeastern-most corner (Figure 1-8).

The surface survey was performed with a shielded pancake Geiger-Mueller (GM) probe (Eberline HP 210) and a digital rate meter (Eberline PRS-1 ["Rascal"]). The survey was performed by walking back and forth in each of the squares in an east-west direction, then in a north-south direction, with the probe 6 in. from the ground.

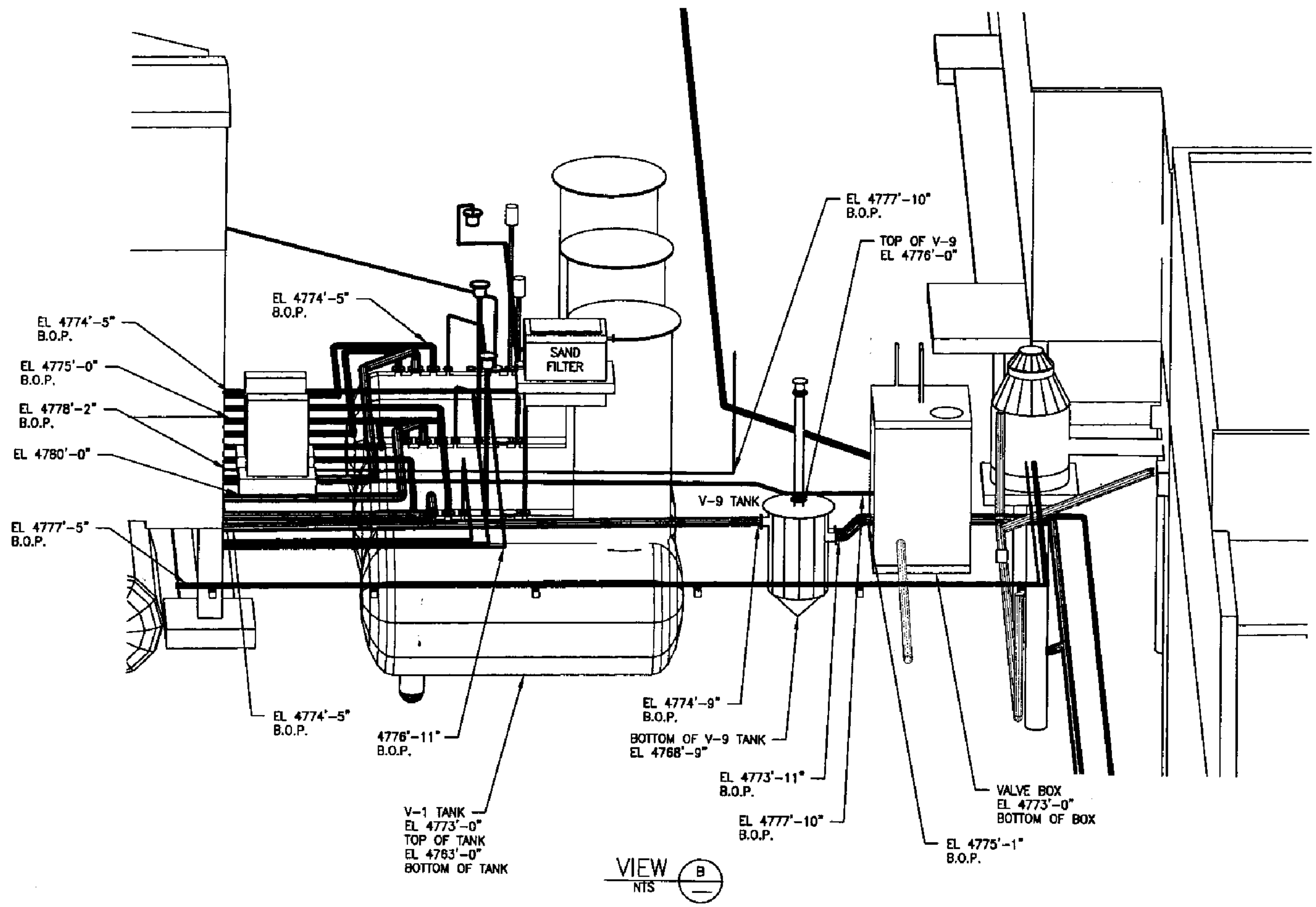

Figure 1-6. Diagram of TSF-18 sand filter.

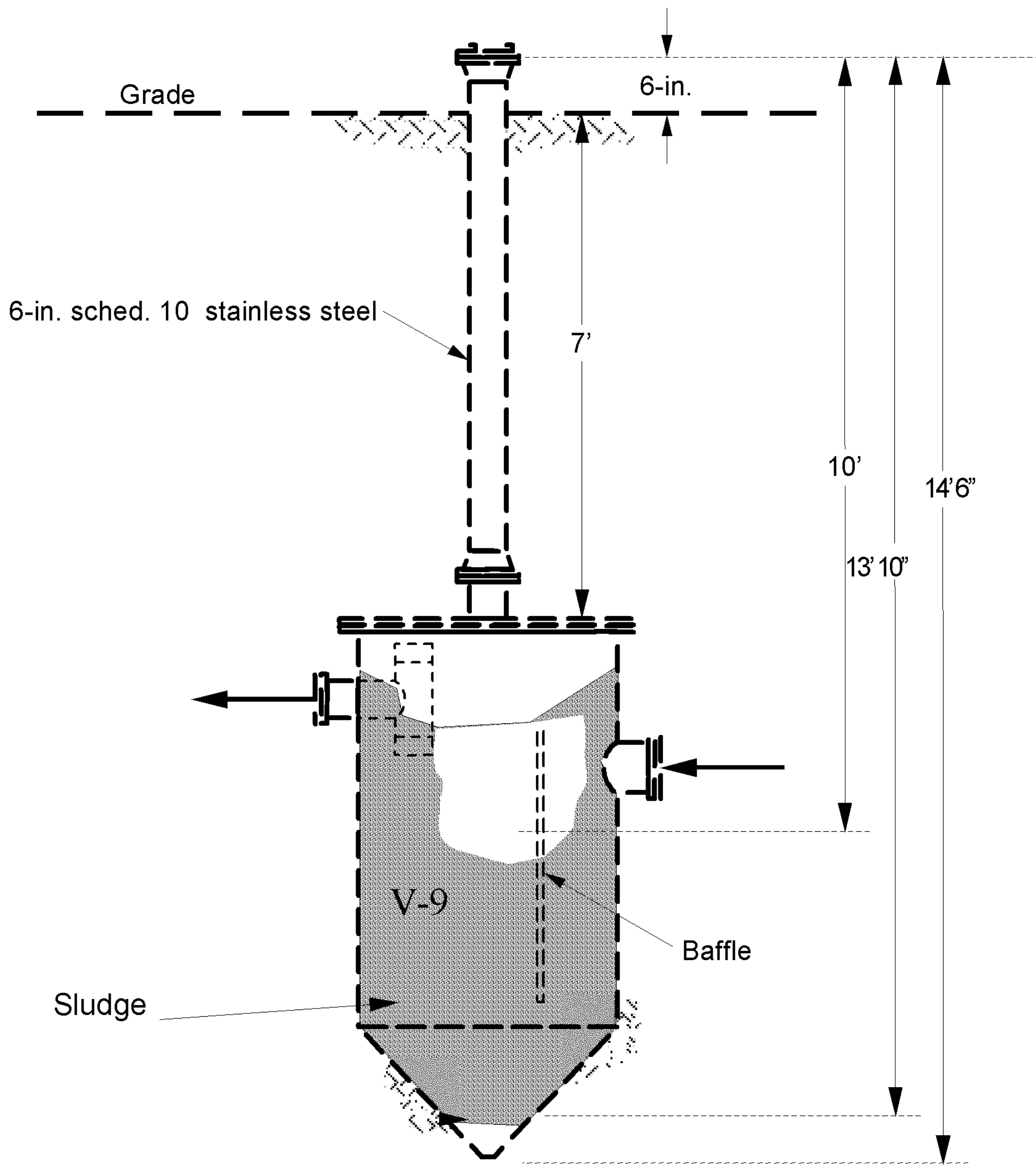

Figure 1-7. Diagram of Tank V-9 at TSF-18.

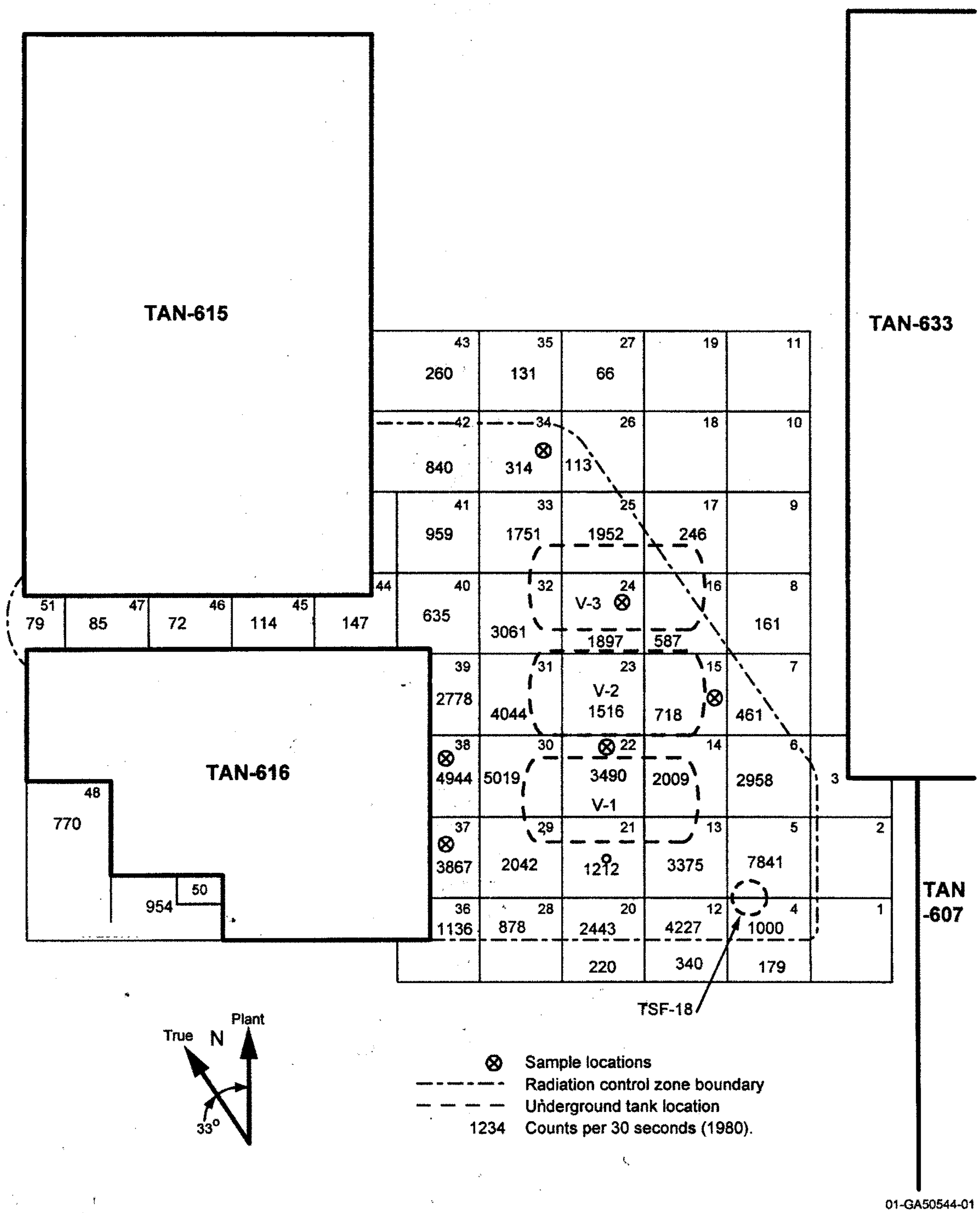

Figure 1-8. 1980 Grid network for surface soil radiological surveys and trench sampling locations.

Six trenches were sampled in this effort as well. Trench locations were selected based on the results of surface radiation surveys. Three grid locations were selected based on the presence of high surface radiation levels (grid squares 22, 38, and 37), and three were selected based on the presence of low surface radiation levels (grid squares 15, 24, and 34). Trenches were dug to 1.5 m (5 ft) long by 0.9 m (3 ft) wide and 36 in. in depth. Samples were collected at 6-in. intervals starting at the surface. A composite of three samples was collected at each interval: one from each side and one from the middle. The samples were then analyzed at the Test Reactor Area (TRA) radiological measurements laboratory (RML) for gamma emitters. Survey results of both the surface samples and the trench samples are presented in the remedial design/remedial action (RD/RA) work plan (WP) (DOE-ID 2003a). Results exhibited high concentrations of Cs-137 and Co-60 in all surface samples. In all cases, the concentrations at 91.4 cm (36 in.) were elevated above background activities (EG&G internal technical report 1983).

Soil samples were also collected in three locations within the V-Tanks area in 1988. The purpose of the sampling was to provide additional site-specific data, as a part of the DOE Environmental Survey. The soil samples were collected with split barrel samplers and did not go beyond a depth of 2 ft. Two of the borings were located west of the V-Tanks, and the other was located north of the V-Tanks (INEEL 1994). While the results of the 1988 DOE Environmental Survey were unpublished, the results were reviewed to evaluate the TSF-09/18 area. The sampling results of the soil borings indicated that soil surrounding the V-Tanks showed elevated levels of beta/gamma activity (>.5mR/h) (INEEL 1994).

1.4.2 1993 Track 2 Soil Sampling

The 1993 Track 2 investigation included the collection of eight samples from three boreholes known as Locations A, B, and C. Location A was just south of the valve pit next to TSF-18; Location B was just off the southwest corner of Tank V-2; and Location C was in the drainage ditch north of Tank V-3.

The soil at Location A was sampled at the surface from 0 to 0.5 ft deep, the shallow subsurface from 0 to 4 ft deep, and the deep subsurface from 20 to 24 ft deep. The soil at Location B was sampled at the surface from 0 to 0.5 ft deep and the shallow subsurface from 5 to 8 ft deep. The soil at Location C was sampled at the surface from 0 to 0.5 ft deep, the shallow subsurface from 0 to 4.5 ft deep, and the deep subsurface from 18 to 22 ft deep. Table 1-1 presents the 1993 analytical results for Locations A, B, and C. Analytical results are also presented in Figure 1-9, which also shows the types and locations of samples collected (surface, shallow, or deep boring).

Results of the 1993 Track 2 investigation show that surface soil contamination ranged from 16 to 18 pCi/g gross alpha and 76 to 1,100 pCi/g gross beta. Subsurface measurements of gross alpha ranged from 9.2 to 26.0 pCi/g and gross beta ranged from 47 to 160 pCi/g. Cobalt-60 (Co-60) and Cs-137 were detected in the deep subsurface with maximum concentrations of 0.3 pCi/g and 103 pCi/g, respectively. The results of the inorganic analyses of samples from various intervals in the boreholes did not indicate elevated concentrations of metals at any of the depth locations. Analyses of VOCs and SVOCs show very low concentrations of acetone, trichloroethene, and Aroclor-1254.

1.4.3 1998 Soil Sampling

The soils surrounding the tanks were resampled in 1998. A field sampling plan (FSP) (DOE-ID 2003b) was prepared to direct the collection and analysis of soil samples from various WAG 1 sites, including TSF-09 and TSF-18. (See Figure 1-10 for sampling locations.) The objectives of the soil sampling included:

- Provide specific VOC data for identified contaminants of concern to be used as the basis to support a no-longer-contained-in determination

Table 1-1. 1993 Track 2 soil sampling summary.

	Location A (~5 ft south of Tank V-9)	Location B (~5 ft west of Tank V-2)	Location C (~5 ft west of Tank V-1)
Surface Soil	**(0 ft to 0.5 ft)**	**(0 ft to 0.5 ft)**	**(0 ft to 0.5 ft)**
Gross alpha	18 pCi/g	16 pCi/g	16 pCi/g
Gross beta	210 pCi/g	1,100 pCi/g	76 pCi/g
Shallow Subsurface Soil	**(0 ft to 4 ft)**	**(5 ft to 8 ft)**	**(0 ft to 4.5 ft)**
Gross alpha	9.2 pCi/g	26 pCi/g	11 pCi/g
Gross beta	47 pCi/g	160 pCi/g	20 pCi/g
Co-60	0.24 pCi/g	0.13 pCi/g	
Cs-137	1.19 pCi/g	103 pCi/g	0.06 pCi/g
Barium	124 mg/kg	99.6 mg/kg	201 mg/kg
Cadmium	1.3 mg/kg	1.2 mg/kg	2.3 mg/kg
Chromium	21 mg/kg	14.2 mg/kg	25.5 mg/kg
Lead	17.3 mg/kg	26.7 mg/kg	23.5 mg/kg
Aroclor-1254	—	—	1.08 mg/kg
Deep Subsurface Soil	**(20 ft to 24 ft)**	**(None)**	**(18 ft to 24 ft)**
Gross alpha	4.9 pCi/g	—	12 pCi/g
Gross beta	20 pCi/g	—	49 pCi/g
Co-60	—	—	0.3 pCi/g
Cs-137	—	—	22.1 pCi/g
Barium	236 mg/kg	—	253 mg/kg
Cadmium	2.4 mg/kg	—	2.7 mg/kg
Chromium	32.2 mg/kg	—	31.7 mg/kg
Lead	27.9 mg/kg	—	17.9 mg/kg
Acetone	0.04 mg/kg	—	—
Trichloroethene	0.009 mg/kg	—	0.003 mg/kg

- Provide specific PCB data for identified contaminants of concern to be used to further support as-found concentrations of PCBs in soil

- Provide specific TCLP metals data to be used to support the statement that the soils do not contain TCLP metals at levels regulated under RCRA.

Assuming a 95% confidence upper bound level, it was determined that 12 samples would reasonably achieve the desired confidence level of 90%. Available historical data show low concentrations (approaching the method detection limits). Four borehole locations were randomly chosen from a 10 × 10-ft grid. Three samples collected from discrete depth intervals were collected from each borehole. Shallow surface samples were collected at depths of 1 to 3 ft, 5 to 7 ft, and 8 to 10 ft. Subsurface samples were collected at depths of 10 to 12 ft, 14 to 16 ft, and 18 to 20 ft.

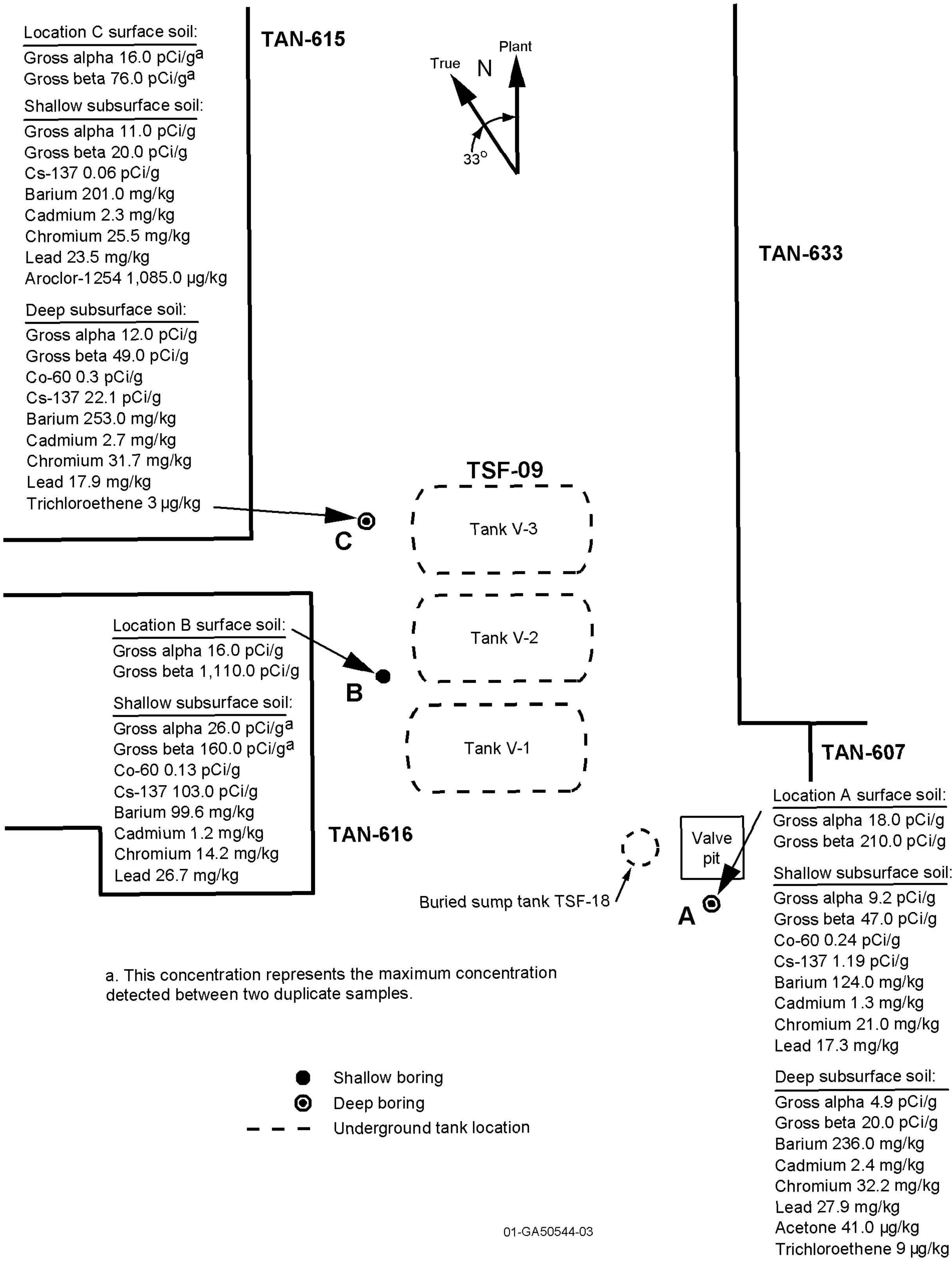

Figure 1-9. 1993 Phase II Track 2 soil sampling analytical results from V-Tanks area.

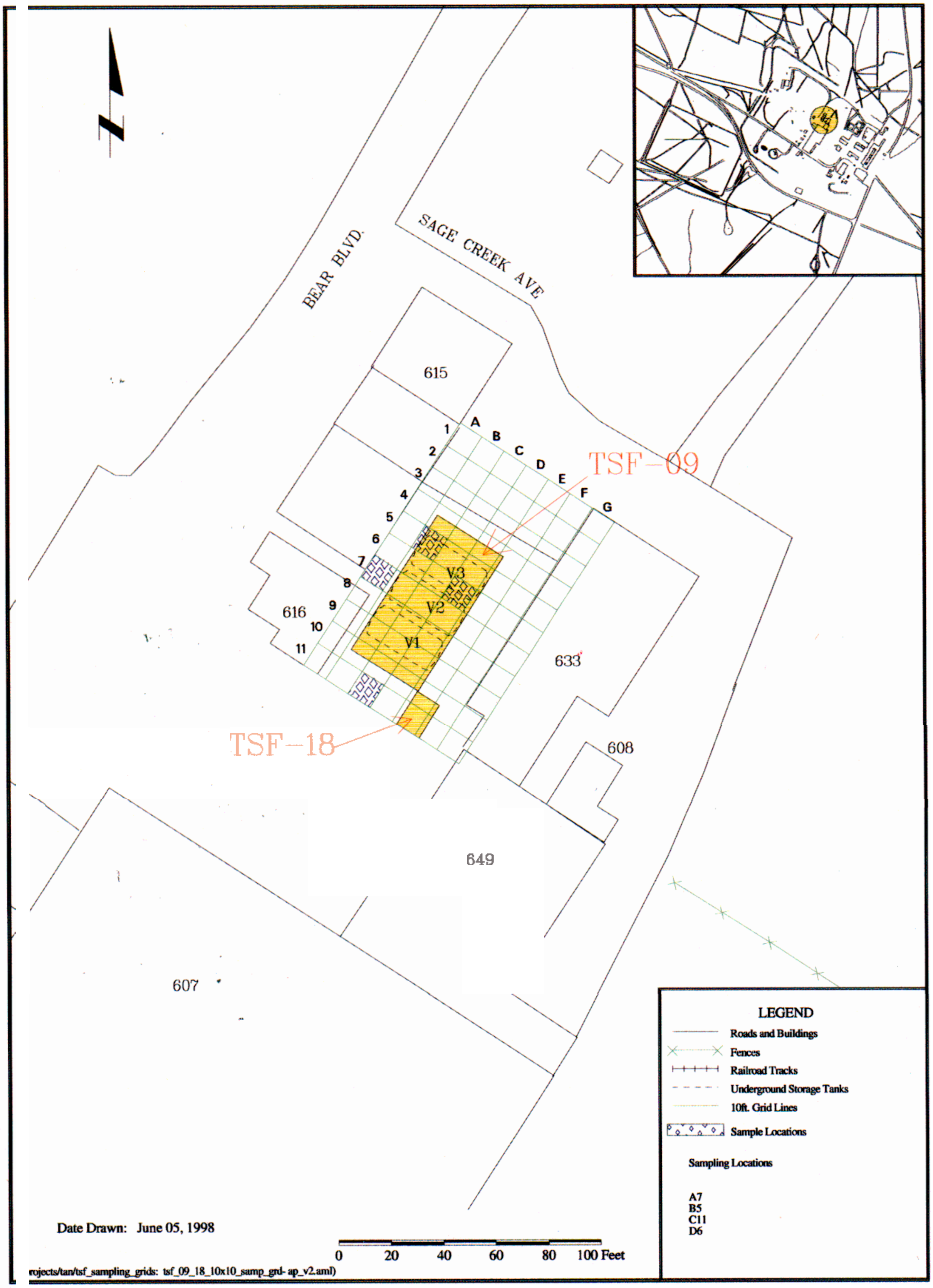

Figure 1-10. 1998 Soil sampling locations.

Analysis of the soil samples TCLP VOCs showed nondetect for all analytes. PCB analyses were also nondetect for all samples. TCLP metal analyses were qualified as nondetect or estimated. All values are below the RCRA-regulated TCLP and land disposal restriction (LDR) concentrations. A letter from the DOE dated November 3, 1998, in reference to the surface soil sampling, stated that the WAG 1 tanks site TCLP VOCs, TCLP metals, and PCBs were nondetect (EPA 1998).

Note: The TAN-615 structure was demolished in 2002. Its inclusion in Figures, 1-8, 1-9, and 1-10 serves to show the soil sampling locations discussed in this HASP.

1.5 Previous Soil Investigations – TSF-21 Valve Pit

1.5.1 1993 Track 2 Scoping Document

The 1993 Track 2 Scoping Document for the TSF-21 valve pit does not go into great detail regarding the soil contamination around the pit. It basically states that the surface soils around the TSF-21 valve pit are known to have the contaminants Cs-137, Co-60, Sr-90, and U-235, and that clean soils have been placed over the contaminated soils from the IET pipe removal spill. The Track 2 document also estimates the worst-case scenario for soil contamination under TSF-21 would be 3894 ft^3 (12 × 11 × 29.5 ft deep).

1.6 Scope of Work

This health and safety plan for the TSF-09/18 (V-Tanks) and TSF-21 early remedial action field sampling, equipment removal and disposal at Wag 1, OU 1-10 includes the following activities as outlined below. This scope of work was intentionally written in general terms to allow project flexibility.

1.6.1 Sampling Activities

Sampling will consist of two types of surface reconnaissance: (1) a surface scan for gamma radiation using a tripod-mounted lead collimated detector, and (2) a high resolution magnetic field map using a rapid geophysical surveyor (RGS). The surface scan for gamma radiation will be used to help locate potential soil sampling points.

Magnetic field mapping will be used to help avoid underground utilities during the soil sampling process. The intended sample locations, including the rationale for location selection and the analytical methods necessary to meet the data needs discussed in Section 3.4 of the field sampling plan for TSF-09/18 (V-Tanks) and TSP-21 at WAG-1, Operable Unit 1-10 remedial action (DOE-ID 2003b).

For the V-Tank sites, sampling will be done in a two-phase process. Phase I will consist of a magnetic field survey of the area to determine the location of underground utilities and a surface gamma scan to locate surface contamination. Phase I is a preliminary investigative effort to be accomplished prior to subsurface soil sampling activities.

These activities are considered low hazard but still involve walking/working surface hazard; slip, trip and fall potential; and lifting hazards. Vehicular traffic other than those used in Phase I may also be present. Phase II consists of a sampling and analysis methodology using conventional drilling and/or augering technique.

1.6.2 V-Tanks Equipment Removal and Disposal

The following will be performed:

- Excavation and relocation of the sand filter and associated filter media

- Video inspection of the line from V-Tank 9 to TAN-616 to validate presence of materials directly upstream of the valve assembly located in TAN-616

- Excavation and isolation of the line between Tank V-9 to TAN-616

- Excavation and disposal of assorted piping in concert with voluntary consent order (VCO) activities.

Voluntary Consent Order work is covered in the *Health and Safety Plan for the Decontamination and Dismantlement of the Liquid Waste Treatment Plant (TAN-616)* (INEEL 2002). Heavy equipment will be employed during excavation and is addressed in a different HASP.

2. HAZARD IDENTIFICATION AND MITIGATION

The overall objective of this section is to identify existing and anticipated hazards based on the TSF-09/18 (V-Tanks), and TSF-21 early remedial action field sampling, equipment removal and disposal at WAG 1,OU 1-10 scope of work and to provide controls to eliminate or mitigate these hazards. These include the following:

- Evaluation of each project task to determine the safety hazards, radiological, chemical, and biological exposure potential to project personnel by all routes of entry

- Establishment of the necessary monitoring and sampling required to evaluate exposure and contamination levels, determine action levels to prevent exposures, and provide specific actions to be followed if action levels are reached

- Determination of necessary engineering controls, isolation methods, administrative controls, work practices, and (where these measures will not adequately control hazards) personal protective equipment (PPE) to further protect project personnel from hazards.

The purpose of this hazard identification section is to lead the user to an understanding of the occupational safety and health hazards associated with project tasks. This will enable project management and safety and health professionals to make effective and efficient decisions related to the equipment, processes, procedures, and the allocation of resources to protect the safety and health of project personnel.

The magnitude of danger presented by these hazards to personnel entering work zones is dependent on both the nature of tasks being performed and the proximity of personnel to the hazards. Engineering controls will be implemented (whenever possible) along with administrative controls, work practices, and PPE to further mitigate potential exposures and hazards. This section describes the chemical, radiological, safety, and environmental hazards that personnel may encounter while conducting project tasks. Hazard mitigation provided in this section in combination with other work controls (e.g., technical procedures, work orders, job safety analysis, and Guide [GDE] –6212, "Hazard Mitigation Guide for Integrated Work Control Process") also will be used where applicable to eliminate or mitigate project hazards.

2.1 Chemical and Radiological Hazards and Mitigation

Personnel may be exposed to chemical and radiological hazards while working at the TSF-09/18 (V-Tanks), and TSF-21 early remedial action field sampling, equipment removal and disposal at WAG 1, OU 1-10.

Table 2-1 lists the worker health-based chemical contaminants of concern that may be encountered while conducting project tasks.

Table 2-1. Evaluation of health-based contaminants of concern at TSF-09/18 (V-Tanks) and TSF-21, WAG 1, OU 1-10.

V-Tank Contaminant Chemicals (CAS No., Vapor Density, and Ionization Energy)	Exposure Limit [a] (PEL/TLV/DAC)	Routes of Exposure [b]	Symptoms of Overexposure (Acute and Chronic)	Target Organs/ System	Labeled as a Carcinogen (source[c,d])	Exposure Potential (all routes without regard to PPE)
Aroclor-1260 (11096-82-5)	Not Available (nearly identical product – Aroclor-1254 [chlorodiphenyl 54%Cl]): 0.5 mg/m^3 – TLV 0.5 mg/m^3 – PEL	Ih, Ig, Con, S	Eye irritation, chloroacne, liver damage, reproductive effects	Skin, eyes, liver, reproductive organs	Not Available Aroclor-1254[c] (chlorodiphenyl 54% Cl) ACGIH - A3[c] IARC - 2A[c] NTP - R[c]	Low potential Maximum concentration detected = 310 mg/kg (sludge)
Carbon Monoxide (6308-0) Vapor density 0.789	50 PPM-PEL 25PPM-TLV	Ih.	Headache, confusion, nausea, dizziness, excessive exposure may be fatal	Blood oxygen-carrying capacity	No	Low-moderate potential associated with equipment operation and cutting operations
Chromium (7440-47-3)	0.5 mg/m^3 – TLV (Cr III) 0.01mg/m^3 – TLV (Cr VI) 1 mg/m^3 - PEL (Cr metal) 0.5 mg/m^3 - PEL (Cr III)	Ih, Ig, Con, S	Eye and skin irritation, lung fibrosis	Eyes, skin, respiratory system	Chromium VI[c] ACGIH - A1[c] IARC - 1[c] NTP - K[c]	Low-moderate potential Maximum concentration detected = 1100 mg/kg (sludge)
Bis(2-ethylhexyl) phthalate (117-81-7)	5 mg/m^3 – TLV 5 mg/m^3 – PEL	Ih, Ig, Con	Eye and mucous membrane irritation	Eyes, respiratory system, CNS, liver, reproductive system, GI tract	ACGIH - A3[c] IARC - 2B[c] NTP - R[c]	Low potential Maximum concentration detected = 1100 mg/kg (sludge)
Lead (7439-92-1)	0.05 mg/m^3 – TLV 0.05 mg/m^3 – PEL	Ih, Ig, Con	Weakness, weight loss, anemia, nausea, vomiting, paralysis, constipation, insomnia, abdominal pain, kidney disease, eye irritation	GI tract, CNS, kidneys, blood, gingival tissue, eyes	ACGIH - A3[c] IARC - 2B[c]	Low potential Maximum concentration detected = 592 mg/kg (sludge)
Mercury (7439-97-6)	0.025 mg/m^3 –TLV 0.1 mg/m^3 Ceiling – PEL	Ih, Ig, Con, S	Eye and skin irritation, chest pain, breathing difficulty, tremor, insomnia, headache, fatigue, gastrointestinal disturbance, weight loss	Eyes, skin, respiratory system, CNS, kidneys	ACGIH - A4[c] IARC - 3[c]	Low-moderate potential Maximum concentration detected = 2110 mg/kg (sludge)

Table 2-1. (continued).

V-Tank Contaminant Chemicals (CAS No., Vapor Density, and Ionization Energy)	Exposure Limit [a] (PEL/TLV/DAC)	Routes of Exposure [b]	Symptoms of Overexposure (Acute and Chronic)	Target Organs/ System	Labeled as a Carcinogen (source[c,d])	Exposure Potential (all routes without regard to PPE)
Nickel (7440-02-0)	1.5 mg/m^3, metal – TLV 0.2 mg/m^3, insoluble – TLV 0.1 mg/m^3, soluble – TLV 1 mg/m^3 – PEL	Ih, Ig, Con	Sensitization dermatitis, allergic asthma, pneumonitis	Nasal cavities, lungs, skin	Insoluble: ACGIH - A1[c] IARC - 1[c] NTP - R[c] Soluble: ACGIH - A4[c] IARC - 1[c] NTP - R[c]	Low potential Maximum concentration detected = 435 mg/kg (sludge)
Silica (14808-60-7)	0.05 mg/m^3 – TLV	Ih	Cough, difficulty breathing, decreased pulmonary function, irritated eyes	Eyes, respiratory system	ACGIH - A2 IARC - 1 NTP – K[c]	
Tetrachloroethene (127-18-4)	25 ppm – TLV 100 ppm Ceiling – TLV 100 ppm – PEL	Ih, Ig, Con, S	Eye, skin, nose, throat, respiratory irritant; nausea; dizziness; headache; drowsiness; red skin; liver damage	Eyes, skin, respiratory system, liver, kidneys, CNS	ACGIH - A3[c] IARC - 2B[c] NTP - R[c]	Low potential Maximum concentration detected = 600 mg/kg (sludge)
1,1,1-Trichloroethane (71-55-6)	350 ppm – TLV 450 ppm Ceiling – TLV 350 ppm – PEL	Ih, Ig, Con	Eye and skin irritation, headache, weakness, CNS, depression, dermatitis, cardiac arrhythmias, liver damage	Eyes, skin, CNS, CVS, liver	ACGIH - A4[c] IARC - 3[c]	Low-moderate potential Maximum concentration detected = 2600 mg/kg (sludge)
Trichloroethene (79-01-6)	50 ppm – TLV 100 ppm Ceiling – TLV 100 ppm – PEL 200 ppm Ceiling – PEL	Ih, Ig, Con, S	Eye and skin irritation, vertigo, fatigue, tremor, drowsiness, nausea, vomiting, dermatitis, cardiac arrhythmias, liver injury	Eyes, skin, respiratory system, heart, liver, kidneys, CNS	ACGIH - A5[c] IARC - 3[c] NTP - R[c]	Moderate potential Maximum concentration detected = 22000 mg/kg (sludge), 410 mg/L (liquid)

Table 2-1. (continued).

V-Tank Contaminant Chemicals (CAS No., Vapor Density, and Ionization Energy)	Exposure Limit [a] (PEL/TLV/DAC)	Routes of Exposure [b]	Symptoms of Overexposure (Acute and Chronic)	Target Organs/ System	Labeled as a Carcinogen (source[c,d])	Exposure Potential (all routes without regard to PPE)
Hexachlorobenzene (118-74-1)	0.002 mg/m^3 – TLV	Ih, Ig, Con, S	Eye and skin irritation, vertigo, fatigue, tremor, drowsiness, nausea, vomiting, dermatitis, cardiac arrhythmias, liver injury	Eyes, skin, respiratory system, heart, liver, kidneys, CNS	ACGIH – A3[c]	Low-moderate potential
Hexachlorobutadiene (87-68-3)	0.02 ppm – TLV	Ih, Ig, Con, S	Eye and skin irritation, vertigo, fatigue, tremor, drowsiness, nausea, vomiting, dermatitis, cardiac arrhythmias, liver injury	Eyes, skin, respiratory system, heart, liver, kidneys, CNS	ACGIH – A3[c]	Low-moderate potential
Dinitrotoluene (25321-14-6)	0.2 mg/m^3 – TLV	Ih, Ig, Con, S	Eye and skin irritation, vertigo, fatigue, tremor, drowsiness, nausea, vomiting, dermatitis, cardiac arrhythmias, liver injury	Eyes, skin, respiratory system, heart, liver, kidneys, CNS, reproductive	ACGIH – A3[c]	Low-moderate potential
Radionuclides					Yes[d]	
Whole body exposure to ionizing radiation	INEEL RCM ACL limit = 1.5 rem/yr whole body exposure	Ih, Ig, Abs, Con	Acute: Purpura, leukopenia, epilation, CNS, gastrointestinal Chronic: Cancer, genetic effects	Whole body		Moderate potential exposure from handling radioactive samples/sludge from the V-Tank
Extremity exposure to ionizing radiation	50 rem/yr extremity exposure limit per INEEL RCM	Direct contact with or proximity to V-9 tank sludge samples	Acute: Purpura, leukopenia, epilation, CNS, gastrointestinal Chronic: Cancer, genetic effects	Extremities (i.e., hands)		Moderate potential exposure from handling highly contaminated samples and sampling equipment at the V-Tank

Table 2-1. (continued).

V-Tank Contaminant Chemicals (CAS No., Vapor Density, and Ionization Energy)	Exposure Limit [a] (PEL/TLV/DAC)	Routes of Exposure [b]	Symptoms of Overexposure (Acute and Chronic)	Target Organs/ System	Labeled as a Carcinogen (source[c,d])	Exposure Potential (all routes without regard to PPE)
Eye exposure to ionizing radiation	15 rem/yr eye exposure limit per INEEL RCM	Proximity to V-9 Tank sludge samples	Chronic: Cataracts	Lens of the eye		Low-moderate potential due to installation and testing of glove box in accordance with MCP-199, and the use of lexan shielding per RCM and RE/RCT direction
Potential internal exposure due to uptake of radionuclides	INEEL RCM ACL limit = 1.5 rem/yr whole body exposure OR: project ALARA dose limit as specified per RWP and/or ALARA review	Breach or failure of glove bag resulting in airborne radioactivity Ih, Ig	Acute: Purpura, leukopenia, epilation, CNS, gastrointestinal Chronic: Cancer, genetic effects	Varies with isotope of concern as defined in INEEL RCM Section 2.0. **Anticipated isotopes to be encountered during V-9 sampling are listed below**:		Low-moderate potential due to installation and testing of glove box in accordance with MCP-199, use of respiratory protection and or containments.
Anticipated isotopes to be encountered during V-9 sampling						
Tritium	2×10^{-5} µCi/ml					
Co-60	1×10^{-8} µCi/ml					
Sr-90	8×10^{-9} µCi/ml					
Cs-137	7×10^{-8} µCi/ml					
Eu-152	1×10^{-8} µCi/ml					
Eu-154	8×10^{-9} µCi/ml					
U-233	2×10^{-11} µCi/ml					
U-234	2×10^{-11} µCi/ml					
U-235	2×10^{-11} µCi/ml					
U-236	2×10^{-11} µCi/ml					
U-238	2×10^{-11} µCi/ml					

Table 2-1. (continued).

V-Tank Contaminant Chemicals (CAS No., Vapor Density, and Ionization Energy)	Exposure Limit [a] (PEL/TLV/DAC)	Routes of Exposure [b]	Symptoms of Overexposure (Acute and Chronic)	Target Organs/ System	Labeled as a Carcinogen (source[c,d])	Exposure Potential (all routes without regard to PPE)
Pu-238	3×10^{-12} µCi/ml					
Pu-239	2×10^{-12} µCi/ml					
Pu-240	2×10^{-12} µCi/ml					
Am-241	2×10^{-12} µCi/ml					

a. American Conference of Governmental Industrial Hygienists (ACGIH) 2002 TLV Booklet and OSHA 29 CFR 1910.1000 Table Z-1 and 2-2.

b. (Ih) inhalation; (Ig) ingestion; (S) skin absorption; (Con) contact hazard.

c. ACGIH: A1 – Confirmed human carcinogen. A2 – Suspected human carcinogen. A3 – Confirmed animal carcinogen with unknown relevance to humans. A4 – Not classifiable as a human carcinogen (due to lack of data). A5 – Not suspected as a human carcinogen. IARC: 1 – Carcinogenic to humans. 2A – Probably carcinogenic to humans (adequate animal data, insufficient human data). 2B – Possibly carcinogenic to humans (insufficient human or animal data). 3 – Not classifiable as to carcinogenicity to humans. 4 – Probably not carcinogenic to humans. NTP: K – Known to be a carcinogen. R – Reasonably anticipated to be a carcinogen (limited evidence in human studies).

d. ICRP = International Council On Radiation Protection

VD = vapor density (Air = 1)
GI = gastrointestinal
RCM = radiological control manual
ACL = Administrative Control Limit
CNS = central nervous system
PEL = permissible exposure limit
DAC = derived air concentration
CVS = cardiovascular system
TLV = threshold limit value
IE = ionization energy
STEL = short-term exposure limit
REM = roentgen equivalent man
eV = electron volts

ALARA = as low as reasonably achievable

MSDSs for these chemicals are available at the WAG 1 V-9 tank sampling project office.

2.1.1 Routes of Exposure

Exposure pathways exist for various hazardous materials and radionuclides at the project site. Engineering controls, monitoring, training, and work controls will mitigate potential contact and uptake of these hazards. However, the potential for exposure to contaminants still exists. Exposure pathways include those listed below:

- **Inhalation** is possible during work. Airborne contaminants may be inhaled and deposited in the respiratory tract.
- **Skin absorption and contact** is possible during work. This can cause corrosion resulting in chemicals burns, uptake through skin absorption, and skin contamination.
- **Ingestion** is possible during work. Uptake of contaminants through the gastrointestinal tract could result in effects such as gastrointestinal irritation, internal tissue irradiation, and deposition to target organs.
- **Injection** while handling hazardous materials by breaking of the skin or migration through an existing wound can result in localized irritation, contamination, uptake of soluble contaminants, and deposition of insoluble contaminants.

Chemical and radiological hazards will be eliminated, isolated, or mitigated to the extent possible during all project tasks. Where they cannot be eliminated or isolated, monitoring for chemical and radiological hazards will be conducted (as described in Section 3) to detect and quantify exposures. Additionally, administrative controls, training, work procedures, and protective equipment will be used to further reduce the likelihood of exposure to these hazards. Table 2-2 summarizes each primary project task, associated hazards, and mitigation procedures.

The safe work permits (SWPs) and radiological work permits (RWPs) may be used in conjunction with this HASP to address specific hazardous operations (e.g., hot work) and radiological conditions at the project site. If used, these permits will further detail specialized PPE and dosimetry requirements.

2.2 Safety, Physical Hazards, and Mitigation

Industrial safety and physical hazards will be encountered while performing work at the project site. Section 4.2 provides general safe-work practices that must be followed at all times. The following sections describe specific industrial safety hazards and procedures to be followed to eliminate or minimize potential hazards to project personnel.

2.2.1 Material Handling and Back Strain

Material handling and maneuvering of various pieces of equipment may result in employee injury. All lifting and material-handling tasks will be performed in accordance with Management Control Procedure (MCP) -2692, "Preventing Ergonomic and Back Disorders." Personnel will not physically lift objects weighing more than 22 kg (50 lb) or 33% of their body weight (whichever is less) alone. Additionally, back strain and ergonomic considerations must be given to material handling and equipment usage. Mechanical and hydraulic lifting devices should be used to move materials whenever possible. The industrial hygienist will conduct ergonomic evaluations of various project tasks to determine the potential ergonomic hazards and provide recommendations to mitigate these hazards. Applicable requirements from Program Requirements Document (PRD) -2016 or MCP-2739, "Material Handling, Storage, and Disposal," will also be followed.

Table 2-2. Summary of activities, associated hazards, and mitigation of TSF-09/18 (V-Tanks) and TSF-21, WAG 1, OU 1-10.

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
Mobilization and Site Preparation (All support equipment)	Radiological contamination—subsurface soils. Radiation exposure.	Radiological control technician surveys, radiological work permit (RWP) (as required), dosimetry, direct-reading instruments, and compliance with posted entry and exit requirements to project areas.
	Chemical and inorganic contaminants—subsurface soil.	Controlled areas, qualified operators, job safety analyses (JSAs), safe work permits (SWPs), technical procedures (TPRs), or work packages.
	Equipment movement and vehicle traffic—trailers, drill rig, pinch points; ergonomic concerns; and struck-by or caught-between potential.	Trained operators, JSAs, SWPs, TPRs, qualified heavy equipment operator (hoisting and rigging), designated traffic lanes and areas, watch body position, and wear personal protective equipment (PPE).
	Lifting and back strain.	Mechanical equipment movement, proper lifting techniques, and two-person lifts.
	Subsidence of soil from heavy equipment.	Inspect areas before driving equipment on pit surfaces.
	Heat and cold stress.	Industrial hygienist or field team leader (FTL) monitoring and work-rest cycles as required.
	Tripping hazards and working-walking surfaces—ice- and snow-covered surfaces, and drill rig truck deck and ladders.	Salt and sand icy areas. Use nonskid or high-friction materials on walking surfaces.
	Stored energy sources—electrical lines and panels, elevated materials, hoisting and rigging, gas cylinders.	Identify and mark all utilities; ensure all lines and cords are checked for damage and continuity; use ground-fault circuit interrupter (GFCI) on outdoor equipment; comply with minimum clearances for overhead lines; and secure cylinders, caps, and bottles before movement.

Table 2-2. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
Sampling and Drilling	Radiological contamination. Radiation exposure.	Radiological control technician surveys, RWP (as required), dosimetry, direct reading instruments, comply with posted entry and exit requirements to project areas.
	Chemical or inorganic contaminants—subsurface soils.	Controlled areas, qualified operators, JSAs, SWP, TPRs or work package.
	Equipment movement and vehicle traffic—pinch points, struck-by or caught-between potential, drill rig.	Trained operators, JSAs, SWPs, TPRs, qualified heavy equipment operator (hoisting and rigging), designated traffic lanes and areas, watch body position, wear PPE.
	Lifting and back strain, ergonomic concerns.	Proper lifting techniques, two-person lifts (as required).
	Heat and cold stress.	Industrial hygienist (IH) or FTL monitoring and work-rest cycles (as required).
	Tripping hazards and working-walking surfaces—existing probes in the ground, and ice- and snow-covered surfaces.	Awareness of probe locations, salt and sand icy areas, and use nonskid or high-friction footwear on walking surfaces.
Excavate, Backfill, Packaging and Shipment.	Radiological contaminants. Radiation exposure.	Radiological control technician surveys, dosimetry.
	Chemical and inorganic contaminants—subsurface soil and waste, paint, diesel fuel, hydraulic fluid, and oil.	Material safety data sheets for chemicals onsite, industrial hygienist monitoring, and PPE.
	Equipment movement and vehicle traffic—forklift, pinch points, ergonomic concerns, and struck-by or caught-between potential.	Controlled work areas, qualified operators, JSAs, SWPs, TPRs or work package, proper body position, and PPE.
	Lifting and back strain.	Proper lifting techniques, two- or three-person lifts.
	Hazardous noise levels.	Noise surveys and hearing protection (as required).
	Heat and cold stress.	IH or FTL monitoring, work-rest cycles (as required).
	Tripping hazards and working-walking surfaces—existing probes in ground and ice- and snow-covered surfaces.	Awareness, salt and sand icy areas, and use nonskid or high-friction footwear on walking surfaces.

Table 2-2. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
V-Tank Equipment Removal	Radiological contaminants. Radiation exposure.	Radiological control technician surveys, dosimetry.
	Chemical and inorganic contaminants.	Material safety data sheets for chemicals onsite, industrial hygienist monitoring, and PPE.
	Equipment movement and vehicle traffic—forklift, pinch points, ergonomic concerns, and struck-by or caught-between potential.	Controlled work areas, qualified operators, JSAs, SWPs, TPRs or work package, proper body position, and PPE.
	Lifting and back strain.	Proper lifting techniques, two- or three-person lifts.
	Hazardous noise levels.	Noise surveys and hearing protection (as required).
	Heat and cold stress.	IH or FTL monitoring, work-rest cycles (as required).
	Tripping hazards and working-walking surfaces—existing probes in the ground, and ice- and snow-covered surfaces.	Salt and sand icy areas, and use nonskid or high-friction footwear on walking surfaces.

2.2.2 Repetitive Motion and Musculoskeletal Disorders

Physical tasks to be conducted may expose personnel to repetitive-motion hazards, undue physical stress, overexertion, awkward postures, or other ergonomic risk factors that may lead to musculoskeletal disorders. Musculoskeletal disorders can cause a number of conditions including pain, numbness, tingling, stiff joints, difficulty moving, muscle loss, and sometimes paralysis. The assigned project industrial hygienist will evaluate project tasks and provide recommendations to reduce the potential for musculoskeletal disorders in accordance with MCP-2692.

2.2.3 Working and Walking Surfaces

Slippery work surfaces can increase the likelihood of back injuries, overexertion injuries, slips, and falls. The TSF-09/18 (V-Tanks) and TSF-21 early remedial action field sampling, equipment removal and disposal at WAG 1, OU 1-10, presents inherent tripping hazards. Additionally, the potential for slip, trip, and fall hazards will increase during winter months because of ice- and snow-covered surfaces combined with objects beneath the snow. During the prejob briefing, all personnel will be made aware of tripping hazards that cannot be eliminated. Tripping and slip hazards will be evaluated during the course of the project in accordance with PRD-2005 or PRD-5103, "Walking and Working Surfaces."

2.2.4 Elevated Work Areas

Personnel may sometimes be required to work on elevated equipment or at heights above 1.8 m (6 ft). During such work, employees will comply with requirements from PRD-2002 or PRD-5096, "Fall Protection"; and applicable requirements from PRD-2006 or MCP-2709, "Aerial Lifts and Elevating Work Platforms"; PRD-2003 or PRD-5067, "Ladders"; PRD-2004 or PRD-5098, "Scaffolding;" and PRD-2005 or PRD-5103, "Walking and Working Surfaces." Where required, a fall protection plan will be written.

2.2.5 Powered Equipment and Tools

Powered equipment and tools present potential physical hazards (e.g., pinch points, electrical hazards, flying debris, struck-by, and caught-between) to personnel operating them. All portable equipment and tools will be properly maintained and used by qualified individuals and in accordance with the manufacturer's specifications. At no time will safety guards be removed. Requirements from PRD-2015, "Hand and Portable Power Tools," or PRD-5101, "Portable Equipment and Handheld Power Tools," will be followed for all work performed with powered equipment including hand tools. All tools will be inspected by the user before use.

2.2.6 Electrical Hazards and Energized Systems

Electrical equipment and tools, as well as overhead and underground lines associated with the TSF-09/18 (V-Tanks) and TSF-21 early remedial action field sampling, equipment removal and disposal at WAG 1, OU 1-10 construction or operations, may pose shock or electrocution hazards to personnel. Safety-related work practices will be employed to prevent electric shock or other injuries resulting from direct or indirect electrical contact. If work on energized systems is necessary, these practices will conform to the requirements in PRD-2011or PRD-5099, "Electrical Safety"; MCP-3650, "Chapter IX Level I Lockout and Tagouts"; MCP-3651, "Chapter IX Level II Lockouts and Tagouts"; PRD-2012, "Lockouts and Tagouts"; and Parts I through III of the National Fire Protection Act 70E. In addition, all electrical work will be reviewed and completed under the appropriate work controls (e.g., technical procedures [TPRs] and work orders). When working around overhead lines, clearances will be maintained at all times. Additionally, all underground utilities and installations will be identified before conducting excavation activities in accordance with PRD-2014, "Excavation and Surface Penetrations."

2.2.7 Fire and Flammable Materials Hazards

Fuel will be required for equipment use during the TSF-09/18 (V-Tanks) and TSF-21 early remedial action field sampling, equipment removal and disposal at WAG 1, OU 1-10 operations. Flammable hazards may include (1) transfer and storage of flammable or combustible liquids in the operations or construction area and (2) chemical reaction (reduction, oxidation, and exothermic) from incompatible materials. Portable fire extinguishers with a minimum rating of 10A/60BC will be strategically located at the project site to combat Class ABC fires. They will be located in all active operations or construction areas, on or near all facility equipment that have exhaust heat sources, and on or near all equipment capable of generating ignition or having the potential to spark. Guidance from MCP-2707, "Compatible Chemical Storage," will be consulted when storing chemicals.

2.2.7.1 Combustible Materials. Combustible or ignitable materials in contact with or near exhaust manifolds, catalytic converters, or other ignition sources could result in a fire. A fire protection engineer should be contacted if questions arise about potential ignition sources. The accumulation of combustible materials will be strictly controlled. Disposal of combustible materials will be assessed at the end of each shift. Class A combustibles such as trash, cardboard, rags, wood, and plastic will be properly disposed of in appropriate waste containers. The fire protection engineer also may conduct periodic site inspections to ensure all fire protection requirements are being met.

2.2.7.2 Flammable and Combustible Liquids. Fuel used at the site for fueling must be safely stored, handled, and used. Only flammable liquid containers approved by the Factory Mutual and Underwriters Laboratories, and labeled with the contents, will be used to store fuel. All fuel containers will be stored at least 15 m (50 ft) from any facilities and ignition sources or they will be stored inside an approved flammable storage cabinet. Additional requirements are provided in PRD-2201 or MCP-584, "Flammable and Combustible Liquid Storage and Handling." Portable motorized equipment (e.g., generators and light plants) will be shut off and allowed to cool down in accordance with the manufacturer's operating instructions before being refueled to minimize the potential for a fuel fire.

2.2.7.3 Welding, Cutting, or Grinding. Personnel conducting welding, cutting, or grinding tasks may be exposed to molten metal, slag, and flying debris. Additionally, a fire potential exists if combustible materials are not cleared from the work area. Requirements from PRD-2010 or PRD-5110 "Welding, Cutting, and Other Hot Work," will be followed whenever these types of activities are conducted.

2.2.8 Pressurized Systems

The hazards presented to personnel, equipment, facilities, or the environment because of inadequately designed or improperly operated pressure (or vacuum) systems include blast effects, shrapnel, fluid jets, release of toxic or asphyxiant materials, contamination, equipment damage, personnel injury, and death. These systems can include pneumatic, hydraulic, vacuum, or compressed gas systems. The requirements of PRD-2009, "Compressed Gases," or PRD-5040, "Handling and Use of Compressed Gases," PRD-5, "Boilers and Unfired Pressure Vessels," and the manufacturer's operating and maintenance instructions must be followed. This includes inspection, maintenance, and testing of systems and components in conformance with American National Standards Institute (ANSI) requirements.

All pressure systems will be operated in the designed operating pressure range, which is typically 10 to 20% less than the maximum allowable working pressure. Additionally, all hoses, fittings, lines, gauges, and system components will be rated for the system for at least the maximum allowable working pressure (generally the relief set point). The project safety professional should be consulted about any questions of pressure systems in use at the project site.

2.2.9 Cryogenics

All cryogenic tasks will be conducted and protective equipment worn in accordance with PRD-5038, "Cryogenic Systems." Personal protective equipment will be worn at all times when handling, transferring, or dispensing cryogenic liquids in accordance with PRD-5038.

2.2.10 Compressed Gases

All cylinders will be used, stored, handled, and labeled in accordance with PRD-2009, "Compressed Gases." Additionally, the safety professional should be consulted about any compressed gas cylinder storage, transport, and usage issues.

2.2.11 Heavy Equipment and Moving Machinery

Hazards associated with the operation of heavy equipment include injury to personnel (e.g., struck-by and caught-between hazards) and equipment and property damage. All heavy equipment will be operated in the manner in which it was intended and in accordance with manufacturer's instructions. Only authorized qualified personnel will be allowed to operate equipment, and personnel near operating heavy equipment must maintain visual communication with the operator. Personnel will comply with PRD-2020 or MCP-2745, "Heavy Industrial Vehicles," and PRD-2019 or PRD-5123, "Motor Vehicle Safety."

Personnel working around or near cranes or boom trucks will also comply with PRD-600, "Hoisting and Rigging."

Additional safe practices will include the following:

- All heavy equipment will have backup alarms.
- Walking directly behind or to the side of heavy equipment without the operator's knowledge is prohibited. All precautions will be taken before moving heavy equipment.
- While operating heavy equipment in the work area, the equipment operator will maintain communication with a designated person who will be responsible for providing direct voice contact or approved standard hand signals. In addition, all facility personnel in the immediate work area will be made aware of the equipment operations.
- All equipment will be kept out of traffic lanes and access ways and will be stored so as not to endanger personnel at any time.
- All unattended equipment will have appropriate reflectors or be barricaded if left on roadways.
- All parked equipment will have the parking brake set. Chocks will be used when equipment is parked on inclines.
- The swing radius of heavy equipment will be adequately barricaded or marked to prevent personnel from entering into the swing radius.

2.2.12 Excavation, Surface Penetrations, and Outages

Excavation activities will be conducted in conjunction with this project. All surface penetrations with the exception of certain soil sampling activities and related outages will be coordinated through the TAN Utilities and will require submittal of an outage request (i.e., Form 433.1, "Outage Request") for outages (e.g., road, electrical, and water). The submission of an outage request will not be considered an approval to start the work. Other specific outage requirements are addressed in the special conditions section of the management and operating contract. No surface penetrations will be allowed or conducted until the area has been evaluated and an approved subsurface evaluation documented.

All excavation activities will be conducted and monitored in accordance with PRD-2014 or PRD-22, “Excavation and Surface Penetrations,” and 29 CFR 1926, Subpart P, “Excavations.” The following are some key elements from these requirements:

- The location of utility installations (e.g., sewer, telephone, fuel, electric, water lines, or any other underground installations) that could possibly be encountered during excavation work will be determined before opening an excavation.
- Structural ramps that are used solely by employees as a means of access or egress from excavations will be designed by a competent person. Structural ramps used for access or egress of equipment will be designed by a competent person qualified in structural design and will be constructed in accordance with the design. Structural ramps will be inspected in accordance with Form 432.57, “Excavation Checklist.”
- Employees exposed to public vehicular traffic will be provided with, and will wear, warning vests or other suitable garments marked with or made of reflecting or high-visibility material.
- Daily inspections of excavations, areas adjacent to the excavations, and protective systems will be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection will be conducted by the competent person before the start of work and as needed throughout the shift. Inspections also will be made after every rainstorm or other hazard-increasing occurrence.
- Sloping or benching will be constructed and maintained in accordance with the requirements set forth in 29 CFR 1926, Subpart B, Appendix B, for the soil type as classified by the competent person. This classification of the soil deposits will be made based on the results of at least one visual inspection and at least one manual analysis.

2.2.13 Hoisting and Rigging of Equipment

All hoisting and rigging will be performed in accordance with PRD-2007 or PRD-600, “Hoisting and Rigging,” and DOE-STD-1090-01 “Hoisting and Rigging,” as applicable for the TSF-09/18 (V-Tanks) and TSF-21 early remedial action field sampling, equipment removal and disposal at WAG 1, OU 1-10 operations. Hoisting and rigging equipment will show evidence of a current inspection (e.g., tag) and be inspected before use by qualified personnel. Additionally, the operator or designated person for mobile cranes or boom trucks will perform a visual inspection each day or before use (if the crane has not been in regular service) of items such as, but not limited to, the following:

- All control mechanisms for maladjustment that would interfere with proper operation
- Crane hooks and latches for deformation, cracks, and wear
- Hydraulic systems for proper oil level
- Lines, tanks, valves, pumps, and other parts of air or hydraulic systems for leakage
- Hoist ropes for kinking, crushing, birdcaging, and corrosion
- All anti-two-block, two-block warning, and two-block damage prevention systems for proper operation.

Note: The operator or other designated person will examine deficiencies and determine whether they constitute a safety hazard. If deficiencies are found, they will be reported to the safety professional.

2.2.13.1 Drilling Hazards. Drilling will be used at the project site to penetrate to the required depths. Drilling personnel will be aware of potential drilling equipment hazards and body positioning during all material handling tasks. Specific hazards associated with drill rigs are described below.

2.2.13.1.1 Slips (Toothed Wedges)—Slips are toothed wedges positioned between the drill pipe and the master bushing or rotary cable to suspend the drill string in the well bore when it is not supported by the hoist. Most accidents associated with slip operations are related to manual materials handling. Strained backs and shoulders are common.

2.2.13.1.2 Tongs—Tongs are large, counter-weighted wrenches used to break apart torqued couplings on the drill pipe. Both sets of tongs have safety lines; when breakout force is applied to the tongs, the tongs or the safety lines could break and injure a worker standing near them. Accidents can occur when the driller activates the wrong tong lever and an unsecured tong swings across the rig floor at an uncontrolled velocity. A common accident attributable to tongs can occur when a worker has a hand or finger in the wrong place in attempting to swing and latch the tong onto the drill pipe, resulting in crushing injuries to, or amputation of, the fingers.

2.2.13.2 Elevators. Elevators are a set of clamps affixed to the bails on the swivel below the traveling block. They are clamped to each side of a drill pipe and hold the pipe as it is pulled from the well bore. Accidents and injuries can occur during the latching and unlatching tasks; fingers and hands can be caught and crushed in the elevator latch mechanism. If the pipe is overhead when the latching mechanism fails, the pipe may fall on workers working on the drill floor.

2.2.13.3 Catlines. Catlines are used on drilling rigs to hoist material. Accidents that occur during catline operations may injure the worker doing the rigging as well as the operator. Minimal control over hoisting materials can cause sudden and erratic load movements, which may result in hand and foot injuries.

2.2.13.4 Working Surfaces. The rig floor is the working surface for most tasks performed in well drilling operations. The surface is frequently wet from circulating fluid, muddy cuttings, and water used or removed from the borehole during drilling operations. Slippery work surfaces can increase the likelihood of back injuries, overexertion injuries, slips, and falls.

2.2.13.5 Material Handling. The most common type of accident that occurs during material handling is when a load is being handled and a finger or toe is caught between two objects. Rolling stock can shift or fall from a pipe rack or truck bed. Fingers and hands can be caught between sampling barrels, breakout vices, and tools.

2.2.13.6 High-Pressure Lines. A high-pressure diversion system will be used to carry cuttings away from the borehole. All high-pressure lines will be equipped with continuous air monitors (CAMS) and will be secured with properly rated whip checks in the event of a connection failure. The project safety professional will be consulted about the rating and proper placements of whip checks or equivalent restraining devices.

2.2.14 Overhead Objects

Personnel may be exposed to falling overhead objects, debris, or equipment or impact hazards during the course of the project. Where there is a potential for falling debris, overhead impact hazards will be marked by using engineering-controls protective systems, and head protection PPE will be worn. Sources for these hazards will be identified and mitigated in accordance with PRD-2005 or PRD-5103, "Walking and Working Surfaces."

2.2.15 Personal Protective Equipment

Wearing PPE will reduce a worker's ability to move freely, see clearly, and hear directions and noise that might indicate a hazard. In addition, PPE can increase the risk of heat stress. Work activities at the task site will be modified as necessary to ensure that personnel are able to work safely in the required PPE. Work-site personnel will comply with PRD-2001 or PRD-5121, "Personal Protective Equipment," and MCP-432, "Radiological Personal Protective Equipment." All personnel who wear PPE will be trained in its use and limitations in accordance with PRD-2001 or PRD-5121.

2.2.16 Decontamination

Decontamination procedures for personnel and equipment are detailed in Section 11. Potential hazards to personnel conducting decontamination tasks include back strain; slip, trip, and fall hazards; and cross-contamination from contaminated surfaces. Additionally, electrical hazards may be present if powered equipment (e.g., a powered pressure washer) is used. Mitigation of these walking-working surfaces and electrical hazards are addressed in other prior subsections. If a power washer or heated power washer is used, units will be operated in accordance with manufacturer's operating instructions, personnel will wear appropriate PPE to prevent high-pressure spray injuries, use ground-fault circuit protection, and will conduct these tasks only in approved areas. Personnel will wear required PPE at all times during decontamination tasks as listed in Section 5.

2.3 Environmental Hazards and Mitigation

Potential environmental hazards will present potential hazards to personnel during project tasks. These hazards will be identified and mitigated to the extent possible. This section describes these environmental hazards and states what procedures and work practices will be followed to mitigate them.

2.3.1 Noise

Personnel involved in project activities may be exposed to noise levels that exceed 85 decibel A-weighted (dBA) for an 8-hour time-weighted average (TWA) or 83 dBA for a 10-hour TWA. The effects of high sound levels (noise) may include the following:

- Personnel being startled, distracted, or fatigued
- Physical damage to the ear, pain, and temporary or permanent hearing loss
- Interference with communication that would warn of danger.

Where noise levels are suspected of exceeding 80 dBA, noise measurements will be performed in accordance with PRD-2108, "Hearing Conservation," or MCP-2720, "Controlling and Monitoring Exposures to Noise," to determine if personnel are routinely exposed to noise levels in excess of the applicable TWA (85 dBA for 8 hours of exposure or 83 dBA for 10-hour exposures).

Personnel whose noise exposure routinely meets or exceeds the allowable TWA will be enrolled in the INEEL Occupational Medical Program (OMP) (or subcontractor hearing conservation program as applicable). Personnel working on jobs that have noise exposures greater than 85 dBA (84 dBA for a 10-hour TWA) will be required to wear hearing protection until noise levels have been evaluated and will continue to wear the hearing protection specified by the industrial hygienist until directed otherwise. Hearing protection devices will be selected and worn in accordance with PRD-2108 or MCP-2720.

2.3.2 Temperature and Ultraviolet Light Hazards

Construction or project tasks will be conducted during times when there is a potential for heat or cold stress that could present a potential hazard to personnel. The industrial hygienist and HSO will be responsible for obtaining meteorological information to determine if additional heat or cold stress administrative controls are required. All project personnel must understand the hazards associated with heat and cold stress and take preventive measures to minimize the effects. "Heat and Cold Stress" (PRD-2107 or MCP-2704) guidelines will be followed when determining work-rest schedules or halt work activities because of temperature extremes.

2.3.2.1 Heat Stress. High ambient air temperatures can result in increased body temperature, heat fatigue, heat exhaustion, or heat stroke that can lead to symptoms ranging from physical discomfort, unconsciousness, to death. In addition, tasks requiring the use of protective equipment or respiratory protection prevent the body from cooling. Personnel must inform the field team leader (FTL) or HSO when experiencing any signs or symptoms of heat stress or when observing a fellow employee (i.e., buddy) experiencing them. Heat stress stay times will be documented on the appropriate work control document(s), that is, an SWP, prejob briefing form, or other by the HSO in conjunction with the IH (as required) when personnel wear PPE that may increase heat body burden. These stay times will take into account the amount of time spent on a task, the nature of the work (i.e., light, moderate, or heavy), type of PPE worn, and ambient work temperatures. Table 2-3 lists heat stress signs and symptoms of exposure.

2.3.2.2 Low Temperatures and Cold Stress. Personnel will be exposed to low temperatures during fall and winter months or at other times of the year if relatively cool ambient temperatures combined with wet or windy conditions exist. Additional cold weather hazards may exist from working on snow- or ice-covered surfaces. Slip, fall, and material-handling hazards are increased under these conditions. Every effort must be made to ensure walking surfaces are kept clear of ice. The FTL or HSO should be notified immediately if slip or fall hazards are identified at the project locations.

2.3.2.3 Ultraviolet Light Exposure. Personnel will be exposed to ultraviolet light (UV) (i.e., sunlight) when conducting project tasks. Sunlight is the main source of UV known to damage the skin and to cause skin cancer. The amount of UV exposure depends on the strength of the light, the length of exposure, and whether the skin is protected. No UV rays or suntans are safe. The following are mitigative actions that may be taken to minimize UV exposure:

- Wear clothing to cover the skin (long pants [no shorts] and long sleeve or short sleeve shirts [no tank tops])
- Use a sunscreen with a sun protection factor of at least 15
- Wear a hat (hard hat where required)
- Wear UV-absorbing safety glasses
- Limit exposure during peak intensity hours of 10 a.m. to 4 p.m. whenever possible.

Table 2-3. Heat stress signs and symptoms of exposure.

Heat-Related Illness	Signs and Symptoms	Emergency Care
Heat rash	Red skin rash and reduced sweating.	Keep the skin clean. Change all clothing daily. Cover affected areas with powder containing cornstarch or with plain cornstarch.
Heat cramps	Severe muscle cramps and exhaustion, sometimes with dizziness or periods of faintness.	Move the patient to a nearby cool place. Give the patient half-strength electrolytic fluids. If cramps persist, or if signs that are more serious develop, seek medical attention.
Heat exhaustion	Rapid, shallow breathing; weak pulse; cold, clammy skin; heavy perspiration; total body weakness; dizziness that sometimes leads to unconsciousness.	Move the patient to a nearby cool place. Keep the patient at rest and supply half-strength electrolytic fluids. Treat for shock. Seek medical attention. DO NOT TRY TO ADMINISTER FLUIDS TO AN UNCONSCIOUS PATIENT.
Heat stroke	Deep, then shallow, breathing; rapid, strong pulse, then rapid, weak pulse; dry, hot skin; dilated pupils; loss of consciousness (possible coma); seizures or muscular twitching.	Cool the patient rapidly. Treat for shock. If cold packs or ice bags are available, wrap them and place one bag or pack under each armpit, behind each knee, one in the groin, one on each wrist and ankle, and one on each side of the neck. Seek medical attention as rapidly as possible. Monitor the patient's vital signs constantly. DO NOT ADMINISTER FLUIDS OF ANY KIND.

Note: Heat exhaustion and heat stroke are extremely serious conditions that can result in death and should be treated as such. The FTL or designee should immediately request an ambulance (777 or 526-1515) be dispatched from the Test Area North (TAN) (777 or 526-6263), or Central Facilities Area (CFA) -1612 medical facility. The individual should be cooled as described in Table 2-3 based on the nature of the heat stress illness.

2.3.3 Inclement Weather Conditions

When inclement or adverse weather conditions develop that may pose a threat to persons or property at the project site (e.g., sustained strong winds 25 mph or greater, electrical storms, heavy precipitation, or extreme heat or cold), conditions will be evaluated and a decision made by the HSO, with input from other personnel, to halt work, employ compensatory measures, or proceed. The FTL and HSO will comply with INEEL MCPs and facility work control documents that specify limits for inclement weather.

2.3.4 Subsidence

Personnel may be exposed to subsidence hazards during project activities. This is primarily an equipment hazard when driving or operating equipment in subsidence areas; however, personnel also may be at risk from walking in these areas. Where required, personnel will not enter potential subsidence areas until they obtain clearance from the area supervisor or facility shift supervisor. Barriers and postings for potential subsidence areas will be observed at all times.

2.3.5 Biological Hazards

The INEEL is located in an area that provides habitat for various rodents, insects, and vectors (i.e., organisms that carry disease-causing microorganisms from one host to another). The potential exists for encountering nesting materials or other biological hazards and vectors. The hantavirus may be present in the nesting and fecal matter of deer mice. If such materials are disturbed, they can become airborne and create a potential inhalation pathway for the virus. Contact and improper removal of these materials may provide additional inhalation exposure risks.

If suspected rodent nesting or excrement material is encountered, the industrial hygienist will be notified immediately and **no attempt will be made to remove or clean the area**. Following an evaluation of the area, disinfection and removal of such material will be conducted in accordance with MCP-2750, "Preventing Hantavirus Infection."

Snakes, insects, and arachnids (e.g., spiders, ticks, and mosquitoes) also may be encountered. Common areas to avoid include material stacking and staging areas, under existing structures (e.g., trailers and buildings), under boxes, and other areas that provide shelter. Protective clothing will generally prevent insects from coming into direct contact with the skin. If potentially dangerous snakes or spiders are found or are suspected of being present, warn others, keep clear, and contact the industrial hygienist or HSO for additional guidance as required.

Insect repellant (DEET or equivalent) may be required. Areas where standing water has accumulated (e.g., evaporation ponds) provide breeding grounds for mosquitoes and should be avoided. In cases where a large area of standing water is encountered, it may be necessary to pump the water out of the declivity (areas other than the evaporation ponds).

2.3.6 Confined Spaces

Work in confined spaces may subject personnel to risks involving engulfment, entrapment, oxygen deficiency, and toxic or explosive atmospheres. Confined spaces may be identified at the project site. If entry into a confined space is required, then all requirements of MCP-2749 or PRD-2110, "Confined Spaces," will be followed.

2.4 Other Task-Site Hazards

Task-site personnel should continually look for potential hazards and immediately inform the FTL or HSO of the hazards so that action can be taken to correct the condition. All personnel have the authority to initiate STOP WORK actions in accordance with PRD-1004, or MCP-553, "Stop Work Authority," if it is perceived that an imminent safety of health hazard exists, or to take corrective actions within the scope of the work control authorization documents to correct minor safety of health hazards and then inform the FTL.

Personnel working at the task site are responsible to use safe-work practices, report unsafe working conditions or acts, and exercise good housekeeping habits with respect to tools, equipment, and waste throughout the course of the project.

2.5 Site Inspections

Project personnel may participate in site inspections during the work control preparation stage (such as the hazard identification and verification walkdowns), conduct self-assessments or other inspections. Additionally, periodic safety inspections may be performed by the HSO, project manager, or FTL in accordance with MCP-3449, "Safety and Health Inspections," or PRD-1006, "Safety Surveillance."

Targeted or required self-assessments may be performed during investigation and sampling operations in accordance with MCP-8, "Self-Assessment Process for Continuous Improvement." All inspections and assessments will be documented and available for review by the FTL. These inspections will be noted in the FTL or construction engineer logbook. Health and safety professionals present at the task site may, at any time, recommend changes in work habits to the FTL. However, all changes that may affect the work control documents must have concurrence from the appropriate project technical representatives, and a data analysis report will be prepared when required.